CORE DIMENSIONS AND THE JOB DIAGNOSTIC SURVEY : A NEW ZEALAND STUDY

A thesis
submitted in partial fulfilment
of the requirements for the Degree
of
Master of Science in Psychology
in the
University of Canterbury
by
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1979

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ABSTRACT

The problems of the number of core dimensions needed to describe a job, and the ability of the Job Diagnostic Survey to accurately measure these dimensions, were the basis of this study. The data was obtained by administering the Job Diagnostic Survey to 154 supervisors from eleven firms. This data was compared with United States data and showed that New Zealand supervisors scored generally higher on the test variables than did their United States counterparts. The profile of test scores closely matched that of the United States results, on which basis, it was concluded that the Job Diagnostic Survey could be used in the New Zealand situation for diagnostic and evaluative purposes.

Further analyses were done, the first being a factor analysis which showed the Job Diagnostic Survey to be well constructed except for the core dimension variables which were shown to be three in number rather than five. A second analysis was done to assess the ability of the test to discriminate between groups, a task at which it proved to be reasonably effective.

Because of an unexpected effect, thought to be attributable to one firm, a re-analysis of the data was performed, omitting the problem firm. The results of this re-analysis proved that the firm was having some effect, but that the effect was a complex one.

The conclusions reached were that the Job Diagnostic Survey proved to be a reasonably constructed instrument albeit with some imperfections. The number of core dimensions was found to be three rather than five, although the imperfections in the test design was felt to be a contributing factor.

CHAPTER 1

INTRODUCTION

"Work is a central part of life and of society" (Warr and Wall, 1975). Whether work is loved or hated, work will always be important to people and society. However, from the feelings of love and hate come two different consequences for society. Love of work produces high rates of production of goods of high quality, while hatred of work produces low rates of production of low quality, along with high absenteeism and turnover.

A negative attitude to work is obviously undesirable, yet does exist, as evidenced by numerous case studies in the literature, (Porter, Lawler and Hackman, p 280-281, 1975; Warr and Wall, p 10-11, 1975). This gives some cause for concern, and any means of changing this negative attitude to a positive one would be of considerable interest to industry and governments. However, before any solutions can be offered, the causes or contributing factors of the negative attitudes need to be outlined. Moreover, any contributing factors or causes must be related to the motivation of the worker, as motivation forms a control part of much of the modern theories on job.design.

The factors contributing to the motivation of the worker have been of considerable interest to psychologists. If the causes of motivation were known, industry would be able to design jobs which would motivate the workers, with the resulting rise in quality and productivity. However, at present there is no definitive answer on the issue of the causes of motivation. The most recent attempt to find the causes, or contributing factors, of motivation is in the field of task characteristics, job characteristics, or job dimensions. The basic premise surrounding the concept of job dimensions is that each job can be analysed in terms of a number of different dimensions, from which the potential for motivation, inherent in the job, can be found.

This study will attempt to assist in resolving the current issue of how many dimensions are present in jobs, and how well the test instruments used are at measuring the number of dimensions present in a job. Until the dimensionality issue is settled, little progress can be made on the field of worker motivation, and hence in the area of work design, or more accurately, work redesign. It is hoped that this study will assist in settling the dimensionality issue, and the issue of the ability of the test instruments to measure the dimensions.

CHAPTER 2

REVIEW OF THE LITERATURE

Industrial Psychologists have studied many areas of work behaviour, some of which have continued to hold their interest, while others being only passing fads. One which has maintained interest is that of worker motivation, and in particular, which parts of the job motivate the worker. The latter interest is one which is at present leading to research into the dimensionality of jobs, and the relationships of the dimensionality to other aspects of jobs, e.g. attitudes and performance. That this is not a new area of research can be seen in the fact that studies in the general area were being done in 1924 (Wyatt and Ogden). However, the bulk of research has occurred since 1965, although there were sporadic bursts of activity in the '40's and '50's, due mainly to Maslow, and Herzberg (Maslow 1943, 1954, 1970, Herzberg 1966, 1968, Herzberg, Mausner and Snyderman, 1959).

It is possible to relate job satisfaction to job dimensions if we follow the idea of Smith, Kendal and Hulin (1969) that job satisfaction is the feeling the worker has about his job, or are feelings or affective responses to facets of the situation. These facets are similar to the job dimensions of Hackman and Lawler (1971), i.e. variety, autonomy, task identity and feedback, although the first to suggest the idea that some facets of the job can affect performance on the job was Herzberg, Mausner and Snyderman (1959), followed by Turner and Lawrence (1965) and Hackman and Lawler (1971). At present, there is no hard evidence that job satisfaction is related to the concept of job dimensions. However, there is no reason why this should not be so, as the dimensions are purported to affect the worker's motivation, which in turn, should have some effect on job satisfaction.

The recent increase in interest in job dimensions and job satisfaction is, to a large extent, in response to findings that job simplification leads almost inevitably to monotony, boredom and job dissatisfaction (Davis 1957, Kornhauser 1965). The general form of factories today remains along the lines of the fragmented job ideal of Taylor's Scientific Management (1911). Jobs tend to be repetitive, fragmentary, unintegrated and asystemic (Davis and Taylor, 1972). This system has been justified on economic grounds, but, as Wyatt and Ogden (1924) and Fraser (1947) found, this type of production can also have adverse effects on production quality and quantity, as well as producing problems in the area of mental health. These studies were amongst the earliest; others have followed, and have generally confirmed these findings. (Fraser, 1968, Kornhauser 1965).

The search for more interesting jobs has led to a number of job enrichment /job enlargement programmes and studies, and to work redesign studies. These have been labelled as part of what Davis and Taylor (1972) call "the post industrial era" in which new modes of organising work and structuring jobs are stimulated. These studies have generally attempted to deal with

one of two areas :

1. Those concerning the work itself – Herzberg, et al. (1959) and Hackman and Lawler (1971).
2. Those concerning the individual versus the organisation – Emery (1968), Thorsrud and Emery (1969).

Each of these approaches has contributed to the resulting field of job redesign.

The focus of interest in this study is the first of the two above approaches, i.e. that concerning the work itself, with a specific look at how the work affects the motivation of the employee.

One of the early writers whose work was relevant to this field was Maslow (1943, 1954, 1970) who attempted to explain the motivation of the individual in terms of physiological and psychological needs, and the heirarchical relationships between them. Alderfer (1969, 1972) has produced a modification of Maslow's Theory, but both of these theories run into problems when they are asked to answer the question, "Why do these needs originate?" They also give only a general answer to the question of why the worker reacts to job in the particular way he does.

Another theory which attempts to explain employee motivation is Expectancy Theory (Mitchell, 1974, Mitchell and Biglan, 1971, Vroom, 1964). Expectancy theory attempts to explain motivation in terms of how much "value" a worker will put on a given outcome, or performance leading to an outcome. Expectancy is seen as a momentary belief about the likelihood that a particular act will be followed by a particular outcome. A full view of Expectancy Theory can be found in Lawler (1973). This theory also fails to completely satisfy the questions it is asked to answer in that it is too general in its approach to what constitutes each worker's motivation, in relation to his job. To do this, we need to consider what part the job plays in motivating the worker.

The first systematic approach in this vein is that of Herzberg (Herzberg, et al., 1959, Herzberg, 1966, 1968). Herzberg postulated a two-factor theory with the basic tenets that the primary determinants of employee satisfaction are factors intrinsic to the work (motivation), while dissatisfaction is more typical of factors extrinsic to the work (hygiene factors). Various versions of this theory have been developed, e.g. Wolf (1970). and some evaluation of its basic validity has also been carried out, e.g. King (1970), with not very favourable findings. In general, the two-factor theory has been found to be too simplistic (Dunnette, Campbell and Hakel, 1967) and generally difficult to find empirical support for. (See Porter, Lawler and Hackman, 1975, for a general review of the literature).

An alternative line of theorizing developed from the work of Turner and Lawrence (1965), who attempted to provide more data on how the differences between jobs affect workers. From their data, they obtained six "requisite task attributes, i.e. variety, autonomy, task identity and feedback. Hackman and Lawler's study has generated some follow up research (Barnes, 1975; Brief and Aldag, 1975, Clarke, 1979; Cooper, 1973; Dunham, 1976; North, 1979, Sims and Szilagyi, 1975; Sims, Szilagyi and Keller, 1975; Rousseau, 1977). This research has begun to focus on the issue of minimum dimensionality. There are three

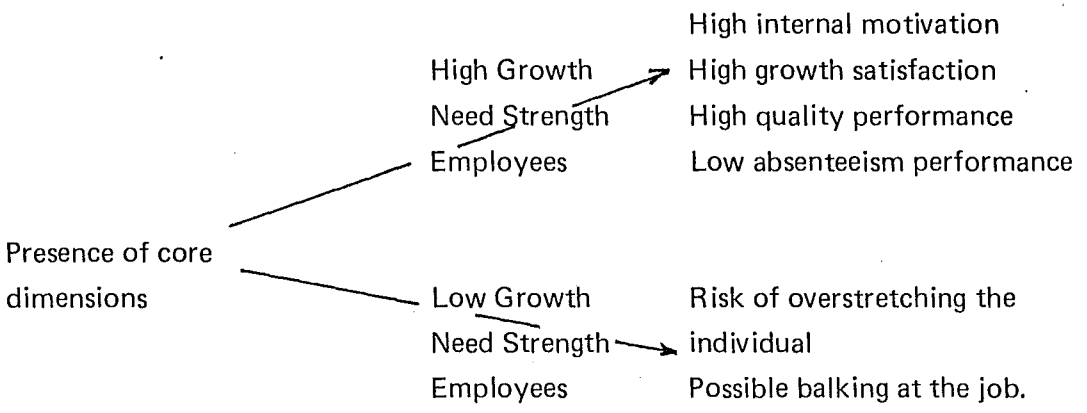
schools of thought on this issue, one being that of Sims et al, which holds that more than four core dimensions are necessary to adequately describe a job, while the opposite school holds that at least two core dimensions are not empirically different, e.g. Task Significance and Job Feedback (Rousseau, 1977), and that a single dimensional representation of job characteristics may be more valid (Cooper, 1974; Dunham, 1976; Rousseau, 1977). The middle school is one which fundamentally agrees with Hackman and Lawler's original findings (Barnes, 1975; Brief and Aldag, 1975; Hackman and Oldham (1975).

Hackman and Oldham developed the original theory to include Task Significance. From this development, they presented a model by which the motivating potential of any job can be measured. The formula used for this is :-

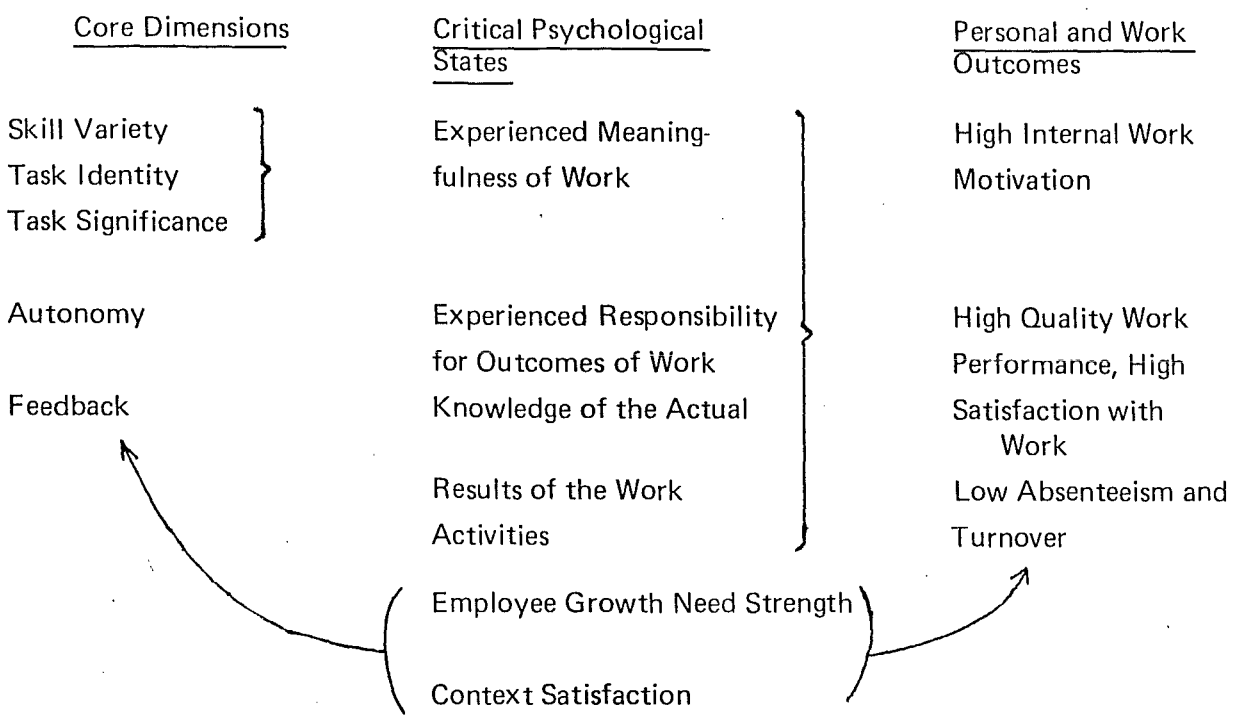
$$\text{M.P.S.} = \frac{(\text{Skill Variety} \times \text{Task Identity} \times \text{Task Significance}) \times 3}{\text{Autonomy} \times \text{Feedback.}}$$

(M.P.S. is the Motivating Potential Score)

The scores for each dimension were based on data obtained from the Job Diagnostic Survey (J.D.S.) designed by Hackman and Oldham (1975). Another concept used by Hackman and Oldham is that of Growth Need Strength. They see this as tapping the strength of the desire for growth "satisfaction" in the respondent. The Growth Need Strength is seen as moderating the relationship between the core dimensions and the satisfaction, performance and motivation of the worker, and is generally seen as being used as a predictor of the natures of both satisfaction and performance. Oldham, Hackman and Pearce (1976) have found that employees with a high Growth Need Strength, and who also are satisfied with the work content, respond more positively to enriched jobs, than do those with low Growth Need Strength, and who are dissatisfied. The following shows some of the general influences (Hackman, Oldham, Janson and Purdy, 1976):—



Hackman and Oldham presented the relationships between the core dimensions and the work and personal outcomes as follows :-



This diagram shows how each dimension affects the outcome for the worker. The Growth Need Strength, or need for personal growth and development, is shown here to be one of the Critical Psychological States, which Hackman and Oldham feel to be the causal core of the model. Others seeing Growth Need Strength as moderating the relationship between the motivating potential and employee reactions include Brief and Aldag (1975), Hackman and Lawler (1972), Wanous (1972) and Wofford (1971).

The literature on job dimensions is not restricted to the arguments over the dimensional structure per se. There are the studies which deal with the relationships between job characteristics, or dimensions, and job attitudes: Blood (1969), Carnall and Wild (1974), Cummings and Bigelow (1976) Lawler and Ball (1971), Stone (1976), and Stone and Porter (1975). There are also a number of studies which look at job satisfaction and attempt to relate it to other aspects like performance, the degree of specialisation, as a function of the worker-environment interaction and the moderating effect of the organisation. In as much as many of these studies rely, to some extent, on the concept of job dimensions, they should be considered as part of the total picture. They are, however, not of immediate relevance to this particular study, which will deal more with the problem of dimensionality of the Job Diagnostic Survey.

The aim of this study was to first attempt a replication in New Zealand of Hackman and Lawler's study, and secondly, to attempt to ascertain how many dimensions there are, as measured by the Job Diagnostic Survey. A third aim was to provide information about supervisors, how they were motivated by their jobs, and the relative importance of each dimension in their jobs.

A search of the literature relating to motivation and task design revealed little literature relating directly to supervisors as a group. Rather, the literature tended to focus on how

supervisors motivated others. (Davis and Valfer, 1965; Oldham, 1974; Rao, Philip and Mohuiddin, 1976). The limited number of studies which were done either mentioned supervisors as part of the whole sample, but did not give a detailed analysis of supervisors as a separate group (Hackman and Lawler, 1971), or implied that supervisors were included in the sample, by listing the upper and lower limits of the sample tested, and once again, gave no detailed analysis (Dunham, 1976; Aldag and Brief, 1977; Hackman and Oldham, 1975, 1976; Sims and Szilagyi, 1976). Oldham, Hackman and Stepina (1978) seem to be the source of detailed data on supervisors as a group. Hence, this study will attempt to contribute something to the understanding of supervisors and the way in which their jobs are designed. This is especially so for the New Zealand situation where no information of this nature seems to be available at present.

CHAPTER 3

METHOD

Subjects

Eleven South Island firms participated in the study, of which all but two were from the same industrial region. The subjects from each firm were all volunteers, and were all supervisors and all were assured of anonymity. The sample sizes for the various firms ranged from four to thirty-one, with the total sample size being 154, of which 116 were male and 38 females.

Instrument

The test instrument used was the Job Diagnostic Survey developed by Hackman and Oldham (1975). The questionnaire remained substantially unchanged except for three questions which had a common usage New Zealand word substituted for a word of United States origin. This was done in order to prevent any ambiguity on the part of the questions. (see Appendix 4).

Procedure

The questionnaires were administered, where possible, by the researcher, either singly, or in groups. One firm was unable to be surveyed in this manner, so that copies of the questionnaire, accompanied by a covering letter, were passed to a management representative, who in turn distributed the questionnaire amongst the employees.

Analyses

1. **Correlation matrix** – for comparison of the interrelationships between the variables, between the New Zealand and United States samples.

2. **Principal Components Factor Analysis** – on (a) all 20 variables (b) The first seven variables

   The objective is to assess the dimensionality of the Job Diagnostic Survey.

3. **Multiple Discriminant Analysis** – to test the ability of the Job Diagnostic Survey to discriminate between groups (firms).

CHAPTER 4

RESULTS

The data obtained in this study will be dealt with in two sections. The first section involves comparisons between the New Zealand and United States samples, comparing United States Total and Supervisor samples, where possible, with the New Zealand sample. The second section will deal with the "job dimensions" concept, and the ability of the Job Diagnostic Survey to measure these and the remaining variables (see Appendix I for the complete list of variables).

SAMPLE COMPARISONS

In the first section, the different sample sizes are important, as they can indicate which comparisons are most likely to be valid. The United States Total sample size is 6930, while the United States Supervisor sample size is 74. The New Zealand sample size is 154.

The first comparison is shown in Fig. 1 which shows the distribution of ages of the New Zealand and United States Total samples. The figure shows that the New Zealand sample tends to be older than the United States sample. Fig. 2 shows the distribution of education levels, for the New Zealand sample only. A direct comparison with the United States sample was not possible because the United States education categories are not directly comparable with those of New Zealand. However, a summary of the United States distribution is given in Fig. 2a, with an accompanying key to the United States education categories. Fig. 2 reveals that the New Zealand sample had a low education level, with only a few having qualifications beyond those obtained at secondary school.

Table 1, and Figs. 3 and 4, detail the comparison between the New Zealand and United States Total and Supervisor samples on the variables tested by the Job Diagnostic Survey. Figs 3 and 4 show that the general trend of the United States data, for both United States samples, is followed by the New Zealand sample, although the New Zealand sample tends to score higher than the United States samples. There are four exceptions, i.e. Task Identity, Internal Work Motivation, Growth Need Strength (both Would Like and Job Choice). Of these, the Task Identity and Growth Need Strength (Would Like) variables deviate the most from the general trend of the results, followed by Internal Work Motivation.

FIG. 1.

PERCENTAGE OF SAMPLES IN EACH AGE GROUP

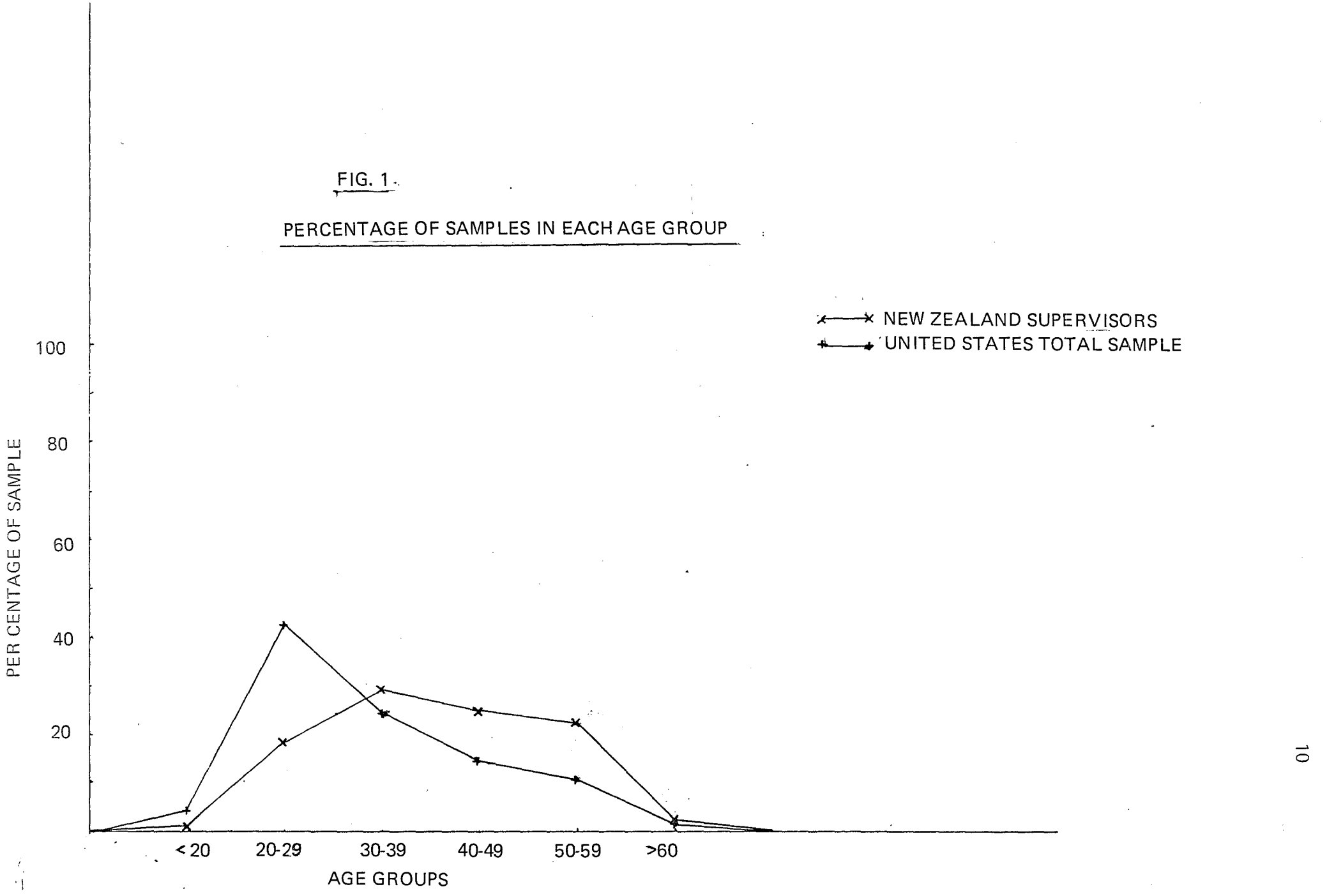
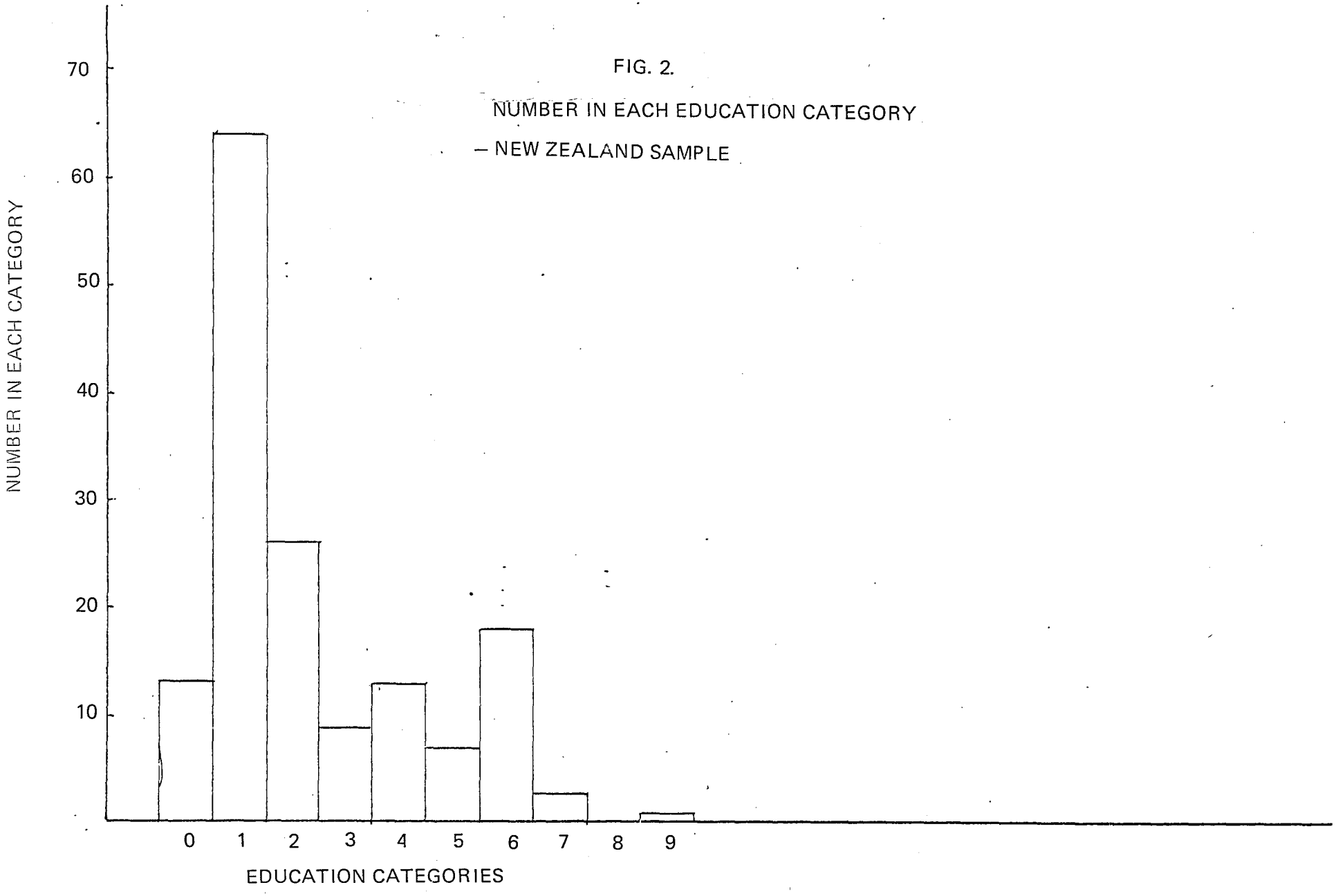


FIG. 2.

NUMBER IN EACH EDUCATION CATEGORY

— NEW ZEALAND SAMPLE



KEY TO EDUCATION CATEGORIES

0 - NO HIGH SCHOOL

1 - HIGH SCHOOL

2 - HIGH SCHOOL – S.C.

3 - HIGH SCHOOL – U.E. OR ABOVE

4 - TECHNICAL INSTITUTE EXPERIENCE

5 - SOME UNIVERSITY EXPERIENCE (OTHER THAN TECHNICAL INSTITUTE)

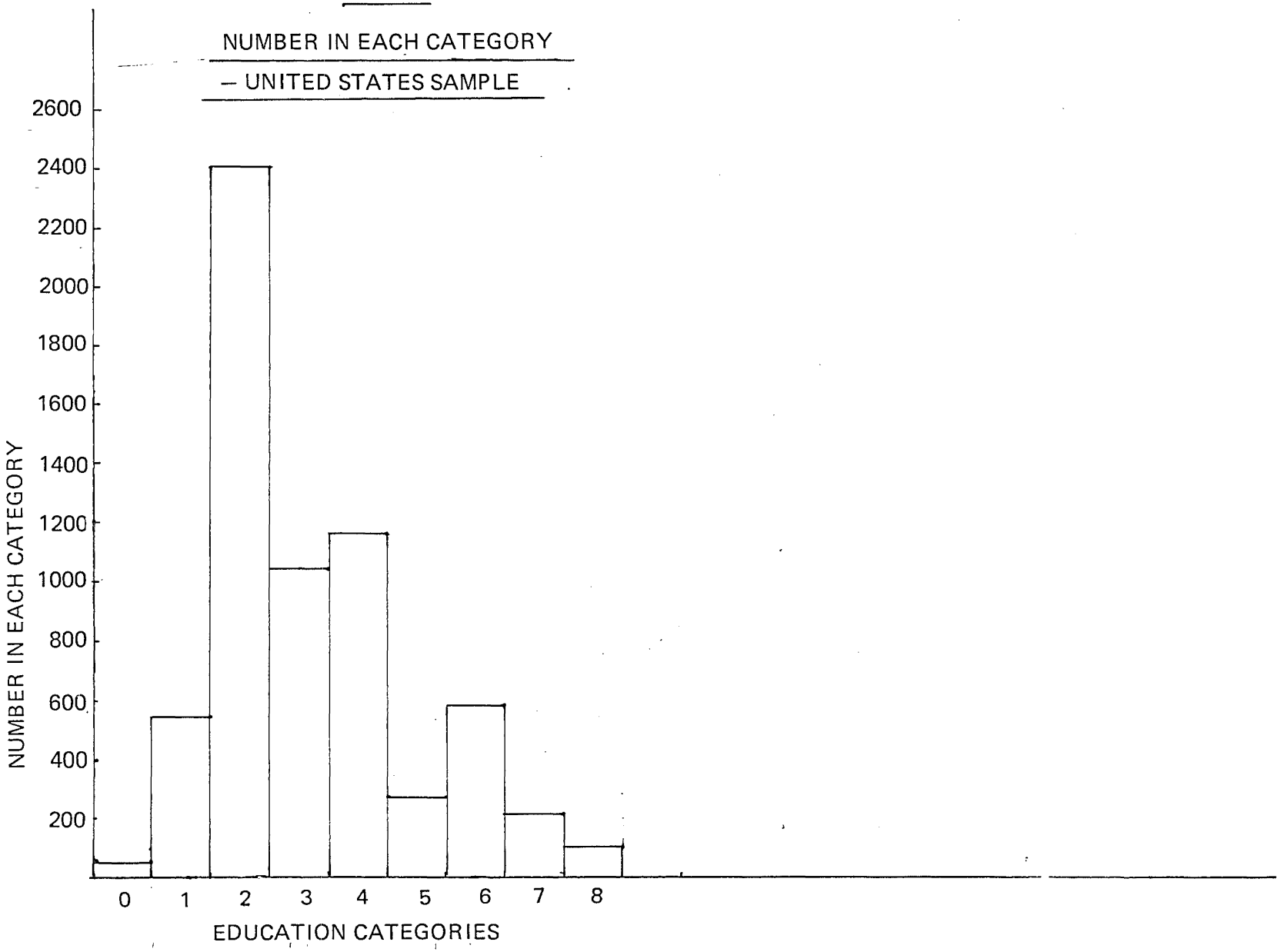
6 - TECHNICAL INSTITUTE

7 - UNIVERSITY DEGREE

8 - SOME GRADUATE WORK

9 - MASTERS OR HIGHER DEGREE

FIG. 2a.


NUMBER IN EACH CATEGORY
— UNITED STATES SAMPLE
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
NUMBER IN EACH CATEGORY
0
1
2
3
4
5
6
7
8
EDUCATION CATEGORIES

KEY TO EDUCATION CATEGORIES

UNITED STATES SAMPLE

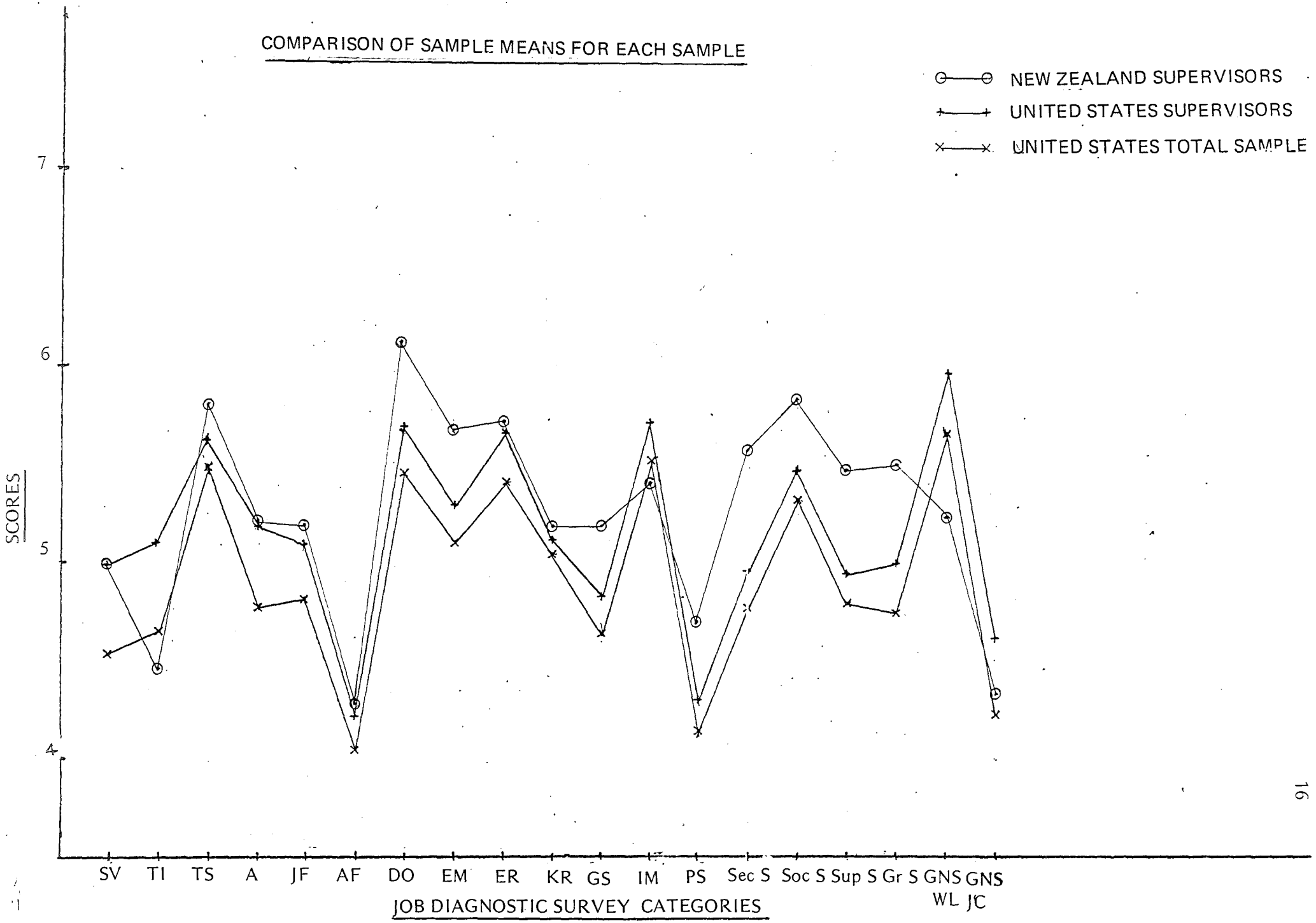
0	-	GRADE SCHOOL
1	-	SOME HIGH SCHOOL
2	-	HIGH SCHOOL DEGREE
3	-	SOME BUSINESS SCHOOL OR TECHNICAL SCHOOL
4	-	SOME COLLEGE
5	-	BUSINESS SCHOOL OR TECHNICAL SCHOOL DEGREE
6	-	COLLEGE DEGREE
7	-	SOME GRADUATE WORK
8	-	GRADUATE DEGREE

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR EACH VARIABLE

– NEW ZEALAND AND UNITED STATES SAMPLES

VARIABLE	N.Z.		U.S. Tot.		U.S. Supervisors.	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
1. Skill Variety	5.00	1.30	4.53	1.57	4.99	1.10
2. Task Identity	4.48	1,41	4.65	1.44	5.11	1.20
3. Task Significance	5.84	1.09	5.49	1.25	5.62	0.92
4. Autonomy	5.24	1.03	4.78	1.39	5.18	1.10
5. Job Feedback	5.21	1.12	4.81	1.34	5.09	1.14
6. Agent Feedback	4.28	1.39	4.06	1.58	4.22	1.37
7. Dealing with Others	6.15	0.80	5.46	1.31	5.68	1.06
8. M.P.S.	144.34	61.03	122.10	69.41	146.70	55.04
9. Experienced Meaningfulness	5.69	1.01	5.10	1.14	5.28	0.95
10. Experienced Responsibility	5;75	0.95	5.40	0.96	5.64	0.78
11. Knowledge of Results	5.20	1.17	5.04	1.14	5.10	0.92
12. General Satisfaction	5.20	1.13	4.65	1.27	4.82	1.08
13. Internal Motivation	5.42	1.03	5.50	0.89	5.68	0.72
14. Pay Satisfaction	4.71	1.57	4.16	1.66	4.30	1.49
15. Security Satisfaction	5.59	1.07	4.76	1.48	4.94	1.30
16. Social Satisfaction	5.85	0.66	5.31	1.02	5.46	0.90
17. Supervisory Satisfaction	5.48	1.24	4.79	1.57	4.93	1.42
18. Growth Satisfaction	5.51	0.94	4.74	1.33	4.98	1.23
19. Would like GNS	5.24	1.16	5.64	1.22	5.94	0.90
20. Job Choice GNS	4.34	0.47	4.23	0.81	4.61	0.67
	N=154		N=6930		N=74	

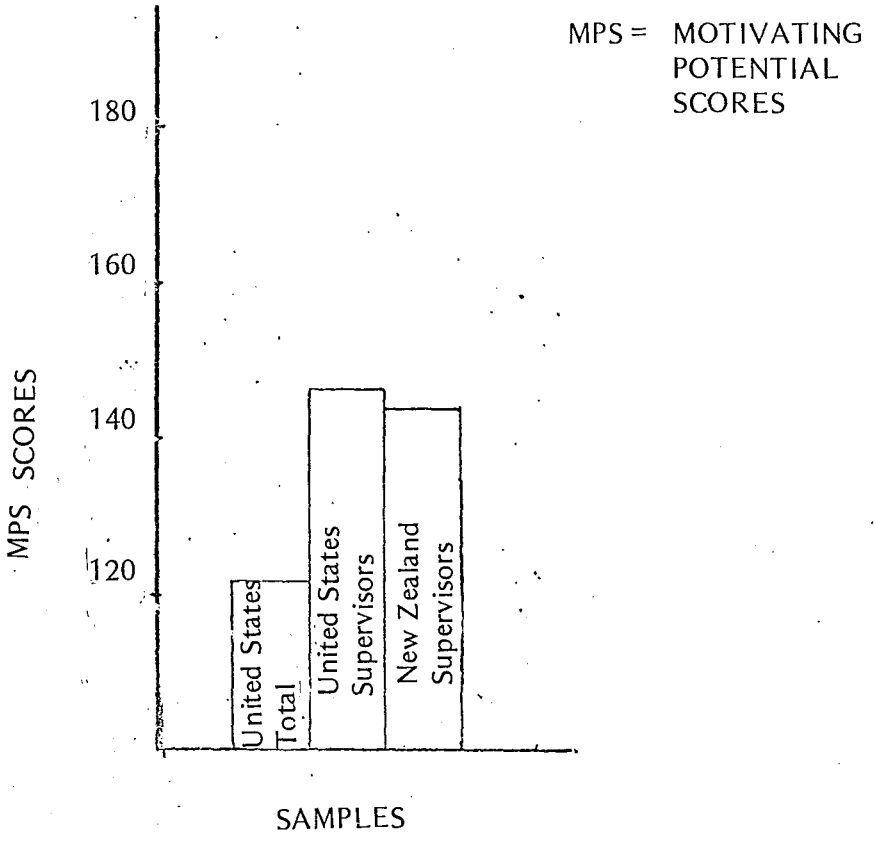

COMPARISON OF SAMPLE MEANS FOR EACH SAMPLE
NEW ZEALAND SUPERVISORS
UNITED STATES SUPERVISORS
UNITED STATES TOTAL SAMPLE
SCORES
7
6
5
4
SV TI TS A JF AF DO EM ER KR GS IM PS Sec S Soc S Sup S Gr S GNS WL GNS JC
JOB DIAGNOSTIC SURVEY CATEGORIES

KEY TO ABBREVIATIONS

SV	SKILL VARIETY
TI	TASK IDENTITY
TS	TASK SIGNIFICANCE
A	AUTONOMY
JF	JOB FEEDBACK
AF	AGENT FEEDBACK
DD	DEALING WITH OTHERS
EM	EXPERIENCED MEANINGFULNESS
ER	EXPERIENCED RESPONSIBILITY
KR	KNOWLEDGE OF RESULTS
GS	GENERAL SATISFACTION
IM	INTERNAL WORK MOTIVATION
PS	PAY SATISFACTION
SECS	SECURITY SATISFACTION
SOCS	SOCIAL SATISFACTION
SUPS	SUPERVISORY SATISFACTION
GRS	GROWTH SATISFACTION
GNSWL	GROWTH NEED STRENGTH – WOULD LIKE
GNSJC	GROWTH NEED STRENGTH – JOB CHOICE
MPS	MOTIVATING POTENTIAL SCORE

FIG. 4

MPS SCORES ACROSS SAMPLES



The Motivating Potential Score, seen in Fig. 4, reveals few differences, especially between the two supervisor groups.

The correlation coefficient matrix (Table 2) a number of variables on which the New Zealand and United States Total sample differ. While some of the correlation coefficient from the New Zealand data mirror the United States figures closely, others reveal little of the interrelationships of the United States sample data, extending even to a change in the direction of the relationship, e.g., Internal Work Motivation correlates positively with Task Identity in the United States data (.16), but negatively for the New Zealand data (–.04). The same trend occurs for Pay Satisfaction and Supervisory Satisfaction correlated with Skill Variety.

The large difference in sample sizes is one factor which must be taken into account in interpreting the correlation coefficient matrix, although, as will be discussed later, other factors may also be important. Despite the problem of differing sample sizes, there are definite groups of variables which have similar correlation coefficients. The first eight variables show some comparability with the United States sample, with no reversals of relationship being evident. The other most coherent group of variables is that of variables nine to twelve, the Experienced Psychological States. The comparability only holds when the groups of variables are correlated with other variables within the group. This indicates a good retention of the interdependence of the variables within each group. The remaining variables in the matrix are scattered with little or no similarity to the United States variables, with little evidence of the grouping seen for the previously discussed groups of variables.

The significance levels point out the problem of sample size, with some correlation coefficients of the same numerical value being not significant in the New Zealand sample, while being significant in the United States sample e.g. Security Satisfaction correlated with Task Identity (New Zealand – .15; United States -.14).

The correlation coefficient matrix indicates the limitations of the Job Diagnostic Survey to measure different samples and yield data. This leads us to the more important aspect of the study i.e., the number of "core dimensions" actually existing in jobs, and success and consistency of the Job Diagnostic Survey in measuring these dimensions and other variables.

Footnote :

The Growth Need Strength (Job Choice) variable must be treated with caution when comparing the samples. This is because the United States data used is of recent origin (Oldham, Hackman and Stepina, 1978); and includes a new method of scoring this variable:- $(1.5 \times \frac{\text{raw score}}{}) - 0.5$, so converting the raw-score from a five point scale to a seven point scale. As the scoring had been completed by the time the new data had arrived from the United States, it was decided that the mean figures for all the Growth Need Strength (Job Choice) scores would be rescaled according to the new method, in order to enable a more valid comparison. The standard deviation figure in Table 1 is as for the five point scale.

TABLE 2

Intercorrelations among J.D.S. Scales Scores For NZ and US Samples

Variables		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.Skill Variety	NZ	1.00																			
	US																				
2.Task Identity	NZ	.28	1.00																		
	US	.22																			
3.Task Significance	NZ	.37	.04	1.00																	
	US	.42	.19																		
4.Autonomy	NZ	.20	.13	.21	1.00																
	US	.44	.30	.32																	
5.Job Feedback	NZ	.19	.24	.32	.31	1.00															
	US	.34	.23	.34	.39																
6.Agent Feedback	NZ	.11	.11	.25	.23	.44	1.00														
	US	.18	.16	.18	.27	.38															
7.Dealing with Others	NZ	.31	-.01	.43	.10	.24	.19	1.00													
	US	.39	-.01	.29	.25	.19	.14														
8.MPS	NZ	.43	.50	.40	.56	.67	.34	.22	1.00												
	US	.61	.46	.51	.79	.76	.37	.29													
9.Experienced Meaningfulness	NZ	.26	.10	.31	.24	.36	.30	.24	.37	1.00											
	US	.45	.22	.45	.42	.39	.29	.20	.52												
10.Experienced Responsibility	NZ	.17	.06	.29	.23	.37	.27	.15	.37	.76	1.00										
	US	.34	.27	.32	.39	.36	.23	.14	.47	.58											
11.Knowledge of Results	NZ	.22	.22	.27	.28	.51	.39	.23	.42	.56	.54	1.00									
	US	.15	.19	.22	.29	.49	.39	.04	.43	.40	.34										
12.General Satisfaction	NZ	.10	.05	.14	.27	.27	.33	.04	.24	.68	.59	.45	1.00								
	US	.33	.20	.29	.42	.35	.32	.13	.46	.66	.49	.42									
13.Internal Motivation	NZ	.20	-.04	.17	.12	.23	.23	.13	.19	.52	.59	.60	.34	1.00							
	US	.34	.16	.33	.31	.32	.25	.22	.40	.57	.59	.23	.43								
14.Pay Satisfaction	NZ	-.13	.02	.00	.05	.18	.18	.05	.03	.21	.21	.11	.36	.07	1.00						
	US	.09	.06	.10	.21	.20	.25	.07	.22	.27	.24	.22	.42	.22							
15.Security Satisfaction	NZ	.00	.15	.12	.02	.14	.19	.01	.18	.16	.09	-.01	.23	-.01	.01	1.00					
	US	.21	.14	.18	.29	.27	.27	.12	.33	.33	.30	.31	.48	.25	.45						
16.Social Satisfaction	NZ	-.00	.12	.19	.17	.13	.23	.14	.17	.32	.20	.16	.37	.04	.07	.29	1.00				
	US	.26	.14	.26	.33	.27	.27	.25	.36	.41	.37	.26	.47	.35	.28	.38					
17.Supervisory Satisfaction	NZ	-.09	.03	.06	.17	.30	.41	-.01	.21	.22	.25	.22	.50	.06	-.00	.34	.52	1.00			
	US	.15	.12	.15	.31	.29	.52	.10	.33	.36	.36	.36	.50	.30	.41	.47	.44				
18.Growth Satisfaction	NZ	.06	.07	.14	.19	.26	.35	.19	.22	.26	.17	.23	.36	.07	.01	.21	.45	.55	1.00		
	US	.48	.24	.38	.54	.43	.36	.23	.59	.65	.51	.39	.69	.48	.43	.51	.57	.55			
19.Would Like GNS	NZ	.33	.02	.13	.14	.16	.05	.17	.18	.04	.13	.06	-.02	.17	-.12	.01	.07	-.00	.01	1.00	
	US	.12	.06	.12	.08	.11	.02	.17	.17	-.00	.12	.02	-.06	.14	-.05	.05	.07	.02	-.03		
20.Job Choice GNS	NZ	.28	.12	.12	.13	.11	.05	.05	.26	.02	.05	.14	-.18	.12	-.21	-.01	-.14	-.25	-.25	.33	1.00
	US	.14	.05	.02	.07	.06	-.00	.14	.14	-.07	.07	-.04	-.09	.03	-.02	.05	-.01	.00	-.08	.42	

NZ: N=154 ; r .208;p .01
US: N=6930; r .081;p .01

DIMENSIONALITY OF THE JOB DIAGNOSTIC SURVEY

The first analysis was a Principal Components Factor Analysis, performed on all twenty variables tested by the Job Diagnostic Survey. These results are given in Table 3. A minimum loading of .5 was chosen, on the basis that this loading enabled all the variables to appear at least once. This loading is more stringent than that of .3 which gives a .01 significance level, but a loading of .3 was found, on examination, to give too many multiple factors, which tended to confuse the picture.

The five factors obtained can be described thus :

Factor 1 – Core Dimensions. These reflect the "wholeness" of the job, how much the job tells the incumbent, and how much motivation the job is able to give.

Factor 2 – The Satisfaction factor.

Factor 3 – The Experienced Psychological State factor.

Factor 4 – A factor reflecting the influence of outside factors on the job, and how the job influences outsiders.

Factor 5 – A Skill–Growth Need Strength factor.

The percentage of variance accounted for by each factor is given in Table 4. The percentage variance was obtained from the computer printout of the Principal Components Factor Analysis (Appendix 2), which gives the cumulative percentage of the eigenvalues, which is also the percentage of the variance accounted for by the solution. Hence, in the above solution, 61 percent of variance is accounted for by the five factor solutions.

In order to obtain a clearer indication of the dimensionality of the "dimensions", another Factor Analysis was done on the first seven variables only. These include Hackman and Lawler's core dimensions, plus two related variables, Agent Feedback being closely related to Job Feedback and Autonomy, and Dealing With Others being closely related to Skill Variety and Task Significance (from Table 2). The result is shown in Table 5, with a solution of three factors, as follows:

Factor 1 – a "wholeness" factor, similar to the first Factor Analysis.

Factor 2 – the interaction between the job and the outside world.

Factor 3 – how much of the job is done by one person.

This solution confirms the previous Factor Analysis and, because it involves only the first seven variables, gives a clearer picture of how these variables are related, and of the dimensionality of the "core dimensions". The percentage of the variance accounted for by this solution was 65.5 percent.

A further test of the Job Diagnostic Survey involved the use of a Multiple Discriminant Analysis. This was used to see how well the Job Diagnostic Survey could discriminate among supervisors from the participating firms. Good discrimination would mean that each firm could be treated as an individual case. Unfortunately, due to a restriction on the number of groups able to be handled by the Multiple Discriminant Analysis, only nine of the eleven firms were able to be included. The basis for exclusion was that of the smallest sample size,

TABLE 3

FACTORS AND EXTRACTED VARIABLES

(With Individual Loadings greater than .500)

FACTOR									
1		2		3		4		5	
M.P.S.	.848	Supervisory Satisfaction	.782	Experienced Meaningfulness	−.848	Dealing with Others	.833	GNS Would Like	.740
Task Identity	.694	Social Satisfaction	.766	Internal Work Motivation	−.811	Task Significance	.695	GNS Job Choice	.659
Job Feedback	.671	Growth Satisfaction	.649	Experienced Responsibility	−.80			Skill Variety	.515
Autonomy	.55	Security Satisfaction	.595	Knowledge of Results	−.701				
		Pay Satisfaction	.576	General Satisfaction	−.656				
		Growth Satisfaction	.506						

TABLE 4

PER CENTAGE OF THE VARIANCE ACCOUNTED FOR BY EACH FACTOR

Factor	1	2	3	4	5
Per Cent Variance	26.97	13.228	8.846	6.545	5.429

TABLE 5

PRINCIPAL COMPONENTS FACTOR ANALYSIS
ON FIRST 7 VARIABLES

	FACTORS AND LOADINGS					
	1		2		3	
VARIABLES	Agent Feedback	.796	Dealing with Others	.813	Task Identity	−.877
	Job Feedback	.771	Task Significance	.763	Skill Variety	−.598
	Autonomy	.581	Skill Variety	.614		

which had the effect of removing two firms, both of whom had only four supervisors participating. This left 146 in the sample, over nine firms. The result of the Multiple Discriminant Analysis can be seen on Table 6. The table is divided in two parts; that of first probabilities i.e. the firm to which the respondent is most likely to belong; and that of second probabilities i.e., the "second choice" for each person.

The results of the Multiple Discriminant Analysis reveal a high correct allocation rate from first probabilities of 63 percent. The total number allocated to each firm (seen in the columns of the table) corresponds closely to the actual number in each firm. The individual firm's correct allocation rates varied, as can be seen in Table 7, the highest being 77 percent, and the lowest being 43 percent.

It was at this stage that an unexpected effect was discovered. When second probabilities were considered, it was found that Firm 10 "lost" a high proportion of its members, while Firm 4 gained a large number of members. Firm 10 was examined closely for possible unique features. This examination revealed that the sample was solely women, mostly part-time, mostly married, and mostly working supervisors. They also worked a wide variety of hours, ranging from 4 to 8.30 p.m. and organised in three shifts. Few, if any, of the other supervisors worked under those conditions. These factors prompted the thought that this firm may be having an unexpected effect on the results of the Principal Components Factor Analysis, and so it was decided to reanalyse the data, but with Firm 10 removed.

The resulting analysis of the data gave rise to the results in Table 8. Using the same minimum loading (.5) a six factor solution was achieved, but with more clouding of the factors, the result of more multiple factors, and some change in loadings of individual variables. The most marked change, apart from the increased number of factors, is in Factor 3, where the loadings on all the variables changed from a negative loading in the first Factor Analysis, to all positive loadings. Factors 2, 3 and 4 retain approximately the same variables as in the full sample analysis. The percentage of the variance accounted for by this solution rose, compared to the first analysis, to 66.3 percent.

An analysis using the first seven variables only, was also done again, with the solution remaining the same as for the full sample analysis (Table 9) although there were some change in loadings, and the percentage of the variance accounted for rose to 67 percent compared with the full sample analysis.

The main effect of the removal of Firm 10 from the analysis seems to have been to change the way in some of the "core dimensions" and some satisfaction variables amont the factors e.g., Growth and Supervisory Satisfaction now on Factor 1, Task Identity and Motivating Potential Score now on Factor 6, with Skill Variety not appearing anywhere.

A Multiple Discriminant Analysis was also done with Firm 10 removed, the results appearing on Table 10. One of the firms shows a rise in correct allocation rate to 100 percent, but most show a drop in correct allocation rates. The overall correct allocation rate dropped to 57 percent, with a slight increase in the correct allocation rate for second probabilities to 13 percent.

TABLE 6 MULTIPLE DISCRIMINANT ANALYSIS

		ALLOCATED TO																	
Firm		1		2		3		4		6		8		9		10		11	
Probability		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Firm																			
	1 N= 5	3	2	0	1	0	0	0	0	2	0	0	0	0	2	0	0	0	0
	2 N= 7	0	1	5	0	1	1	0	0	1	2	0	1	0	1	0	1	0	0
	3 N=15	0	3	0	1	9	1	0	3	2	0	0	1	3	2	1	1	0	3
	4 N=16	0	1	0	1	1	2	7	2	1	1	3	2	1	2	1	2	2	3
ACTUALLY IN	6 N= 13	0	3	0	0	0	1	0	1	9	3	1	2	2	3	0	0	0	0
	8 N= 8	1	0	0	1	1	0	0	0	0	1	6	2	0	4	0	0	0	0
	9 N=30	1	1	2	0	1	5	4	5	0	5	3	5	15	4	1	3	3	2
	10 N=31	0	0	1	3	0	2	1	16	0	2	1	0	2	4	24	1	2	3
	11 N=21	1	0	0	0	0	1	2	12	1	2	0	0	0	2	3	2	14	2
TOTAL	N= 146																		
Total in each category.		6	11	8	7	13	15	14	39	16	16	14	13	23	24	30	9	22	13
		63% Correct Allocation for 1st Probability 11% Correct Allocation for 2nd Probability																	

TABLE 7

CORRECT ALLOCATION RATES FOR INDIVIDUAL FIRMS

Firm	1	2	3	4	6	8	9	10	11
Allocation Rate (%)	60	71	60	43.8	69.2	75	50	77.4	66.6

TABLE 8

FACTORS AND EXTRACTED VARIABLES

(With Individual Loadings-- greater than .500)

FACTOR											
1		2		3		4		5		6	
Job Feedback	.667	Social Satisfaction	.777	Experienced Responsibility	.870	Dealing with Others	.849	GNS Would Like	.863	Task Identity	.839
Agent Feedback	.655	Security Satisfaction	.703	Experienced Meaningfulness	.848	Task Significance	.755	GNS Job Choice	.551	M.P.S.	.595
M.P.S.	.625	Supervisory Satisfaction	.651	Internal Work Motivation	.771			Pay Satisfaction	-.504		
Autonomy	.559	Growth Satisfaction	.519	General Satisfaction	.687						
Growth Satisfaction	.522			Knowledge of Results	.677						
Supervisory Satisfaction	.502										

TABLE 9

PRINCIPAL COMPONENTS FACTOR ANALYSIS
ON FIRST 7 VARIABLES (PARTIAL ANALYSIS)

	FACTORS AND LOADINGS		
	1	2	3
VARIABLE	Agent Feedback .798	Dealing with Others .817	Task Identity —.872
	Job Feedback .779	Task Significance .776	Skill Variety —.619
	Autonomy .626	Skill Variety .587	

TABLE 10

MULTIPLE DISCRIMINANT ANALYSIS — PARTIAL SAMPLE

	ALLOCATED TO															
Firm	1		2		3		4		6		8		9		11	
Probability	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Firm 1 N = 5	5	0	0	1	0	1	0	0	0	2	0	0	0	1	0	0
2 N= 7	0	2	5	1	1	0	0	0	1	1	0	2	0	1	0	0
3 N=15	0	1	0	4	10	0	0	2	1	1	0	1	4	4	0	2
4 N=16	0	1	1	0	1	2	7	3	1	1	2	1	1	4	3	4
6 N=13	0	3	0	0	0	0	0	1	9	3	1	3	2	3	1	0
8 N= 8	1	0	1	1	0	1	0	1	0	2	6	2	0	1	0	0
9 N=30	1	3	1	2	2	4	4	6	0	7	5	2	14	5	3	1
11 N=21	1	0	1	0	0	1	3	14	1	1	0	0	0	2	15	3
TOTAL N= 123																
Total in each category.	8	10	9	9	14	9	14	27	13	18	14	11	21	21	22	14
	57% Correct Allocation for 1st Probability															
	15% Correct Allocation for 2nd Probability															

CHAPTER 5

DISCUSSION

The data in Fig. 1 indicated that the largest proportion of the New Zealand supervisors were in the 30 - 39 age group, contrasting with the United States Total sample, where the largest group was in the 20 - 29 age group. This difference was not unexpected as the United States sample included all levels in an organisation, while the New Zealand sample was restricted to one organisation level, which involved experience and authority, and hence implied some seniority. Thus, in this situation, it could be expected that the New Zealand sample would have an older mean age.

Fig. 2 indicates that New Zealand supervisors are not very well educated, with the bulk of the New Zealand sample tending to have poor education levels, most having only High School education. It is possible that this is related to the age figures in that the tendency towards the older age groups could be related to the poorer education standards when the supervisors left school. The tendency to leave school at an earlier age could also be a contributing factor. The trend evident in the New Zealand data is similar to that found in the United States i.e., that the tendency is for the majority to have relatively low levels of education (Fig. 2a).

It is possible that the education data reflects the educational demands of both New Zealand and United States industries, at least in the cases of those industries studied. Thus, the education data would not necessarily be a true reflection of the educational levels of the population as a whole, or of the working population in particular. Jobs with low skill demands tend to attract, or be filled best by, people with lower educational levels. The reverse could also be said to be true i.e. that people with lower educational levels tend to fill jobs with low level skill demands. If these factors still hold for the New Zealand sample, then the standard of supervision must leave something to be desired. However, the peaks in categories 4 and 6 on Fig. 2 indicate that some supervisors, at least, are furthering their education, and so raising the mean education level of supervisors in New Zealand, and hence, the standard of supervision.

Table 1 and Figs. 3 and 4 show the generally higher scores of the New Zealand supervisors on the Job Diagnostic Survey variables. On the basis of the United States results in Appendix 3. (Tables 17 and 18 from Oldham, Hackman and Stepina, 1978) the higher scores are not unexpected, as the United States results indicate higher scoring as age increases and as education level increases. The New Zealand supervisors tend to fall into educational categories above the New Zealand equivalent of the United States "Some High School" category, after which, in the United States sample, many of the Job Diagnostic Survey scores began to fall.

The relative consistency of the results so far indicate that the Job Diagnostic Survey is reasonably consistent when comparing two Western industrialised nations, but full confirmation of this consistency would demand a more detailed breakdown than is within the scope of this study. The indications at this stage are that the Job Diagnostic Survey could be used for the purposes of comparison and attitude survey, with reasonable confidence, in New Zealand industry.

Table 1 and Fig. 3 indicate four variables which deviate from the generally higher New Zealand scores. These are Task Identity, Internal Work Motivation, Growth Need Strength, Would Like and Job Choice. Of these, Growth Need Strength (Job Choice) should be treated with caution for the reasons given in the Results section. Also, the score for this variable falls between the scores for the two United States samples, so that for these two reasons, Growth Need Strength (Job Choice) will be viewed as part of the general New Zealand trend. The other three variables, however, are not subject to these problems, and are evidence of differences between the national samples.

Task Identity seems to be unique to New Zealand supervisors as similar trends are not seen in the age and education tables in the Appendix 3.Task Identity is identified in Appendix 1 as "the degree to which the job requires completion of a 'whole' or identifiable piece of work i.e., the performance of a job from beginning to end, with a visible outcome." The question arises as to why New Zealand supervisors see their job as low on this variable. One reason may be that for many there is no visible outcome; their efforts to keep production going may be seen by them as a result of the production process rather than their own efforts. This may be especially so in circumstances in which the supervisor is often bypassed. It cannot, however, be claimed that this happens in the firms studied, as there is no evidence that it does so. Management attitudes may have an effect on Task Identity for supervisors in that management may see their supervisors as a kind of glorified worker who tends to do a lot of administrative work and troubleshooting, and so rarely is able to do one identifiable piece of work. This reason could be the result of a lack of an adequate job specification clearly defining the supervisor's duties. An adequate job specification would help to define for the supervisor what an identifiable piece of work is for the position.

It is obvious that there are a number of possible reasons for the low Task Identity score, but it is difficult to define the casual factor, or factors, without detailed job evaluations for all the respondents. Because of this, the question of the cause, or causes of the low Task Identity score must remain unanswered.

Internal Work Motivation is another low scoring variable, although the score is not as low as for Task Identity or Growth Need Strength (Would Like). The low score indicates a lack of motivation to perform effectively on the job. Although it could be related to the Task Identity score, this is unlikely, as Internal Work Motivation has a low, negative, correlation with Task Identity (Table 2). It could have been postulated that because supervisors were unable to get enough Task Identity from their jobs, they were less motivated to perform these jobs as well, but this is very unlikely, and the reverse relationship may be true, due to the negative relationship.

There is, however, a positive, but not significant correlation between the Growth

Need Strength (Would Like) variable and the Internal Work Motivation variable (.17; Table 2). It is likely that the low Growth Need Strength (Would Like) score is affecting the Internal Work Motivation score, rather than vice versa. The low Growth Need Strength score reflects the generally prevailing negative attitudes to enriched jobs i.e., the supervisors would not respond favourable to enriched jobs. The reason for this may be that the supervisors have a "built in" low Internal Work Motivation i.e., it is not the job that is contributing to the low score, but the people currently in the jobs. Whatever the causes or reasons for the low scores, it seems that New Zealand supervisors are poorly motivated, and would respond poorly to any attempts to make their jobs more complex, or enriched. The question arises as to whether this is due to the jobs, the people, or the job climate at the time of the study. A longitudinal study of both the jobs, and the individual supervisors as they move from job to job, or stay put as the case may be, would need to be done in order to define which, if any, of the above causes were contributing to the results, and in the way in which they were acting.

In summary, Table 2 indicates that Task Identity is independent of Internal Work Motivation and Growth Need Strength (Would Like), but that both the Internal Work Motivation and Growth Need Strength variables may be related, although the direction of causality remains in doubt. The underlying causes of the low scores on these variables are difficult to define, but one general cause could be that of cultural differences. The profile of scores on Figs 3 and 4 show that the New Zealand and United States samples are nearly the same on all the variables, except those mentioned above. On these low scoring variables, different cultural values, on the part of both management and labour, could become important, the effect being to subtly change the jobs, and values, of the incumbents.

The possibility that the Job Diagnostic Survey is at fault should not be ruled out. Some support for this doubt comes from Table 2, and later analyses. The interrelationships found between many of the variables found in the United States sample fail to be confirmed on the New Zealand sample and this may indicate a failure on the part of the Job Diagnostic Survey to measure consistently between samples. Table 2 reveals that some groups of variables remain moderately to highly correlated, especially variables 9 – 13, while other variables in the analysis correlate at approximately the same levels as for the United States sample. These variables include some of the core dimensions, the Motivating Potential Score, the Experienced Psychological States, and the Growth Need Strength variables. These groups of variables remain consistent, irrespective of sample. The remaining variables are, on the other hand, sample dependent, giving a measure of the variables on which different samples are most likely to differ.

The concept of core dimensions is considerably weakened, because of the change in the relationships in the New Zealand sample. This can be seen in the effect of some core dimensions becoming independent for the New Zealand sample e.g. Autonomy becomes independent from Task Identity in the New Zealand sample, whereas there was no independence in the United States sample. By definition, the core dimensions should remain the same, regardless of sample, with the relationships between the variable remaining approximately the same. This has not happened in this study, and the results support previous workers who have found that the sample has a direct effect on the core dimensions (Dunham, 1976; Dunham, Brief and Aldag, 1977; Rousseau 1977).

A more detailed investigation of the Job Diagnostic Survey involved the Principal Components Factor Analysis which was used to obtain factorial solutions of the Job Diagnostic Survey. It was expected that groups of variables would form into factors, which, as can be seen in Table 3, did happen. The most noticeable grouping was that of the Experienced Psychological States, the Satisfaction variables, and the Growth Need Strength variables on individual factors. These three groups of variables are obviously well defined, and are groups on which the Job Diagnostic Survey is a good performer. The core dimensions, on the other hand, are fragmented and make up two separate factors, and also contribute to the Growth Need Strength variable. On the basis of these results, the Job Diagnostic Survey can be said to be reasonably well constructed on the Experienced Psychological States, Satisfaction, and Growth Need Strength variables, but that the core dimension variables appear to need redesigning.

Confirmation of the fragmented nature of the core dimensions can be seen in the results of the Factor Analysis of the first seven variables, where the composition of the factors remain essentially the same, forming a solution of three factors. (Table 5). The results of the two Factor Analyses mean that the core dimensions can be reasonably reduced from five to three, these three being able to be summarised as an Autonomy dimension, a Task Significance dimension, and a Skills dimension. These results give strong support to Dunham, Brief and Aldag;Rousseau, et al, who have questioned the dimensionality of the Job Diagnostic Survey, and the number of core dimensions actually needed. Hackman and Lawler's concept of five core dimensions is brought into question by these results, as well as the construct validity of the Job Diagnostic Survey. From these results a question arises: is the inability of various researchers to obtain five core dimensions due to inadequacies in the model, or is it due to the design of the questions on the Job Diagnostic Survey variables? The indications are that both factors may be contributing to these results.

One measure of the ability of the Job Diagnostic Survey to measure what it claims is evidenced in the Multiple Discriminant Analysis table (Table 6). The scores of the respondents in each participating firm were found to be reasonably consistent within the firms i.e., there was a typical response for each firm. In order for this to happen, the Job Diagnostic Survey needed to be a consistent device, and have good reliability. If this had not been the case, there would have been poor discrimination amongst the firms, with the consequent lowering of allocation rates (Table 7). On the basis of these results, the Job Diagnostic Survey seems to be a reasonably consistent device, and would be ideally suited for use in comparison studies, both among and within firms. These results also lend support to the idea that the idea that the failure to obtain five core dimensions is not one of a failure of the Job Diagnostic Survey, but one of the concept itself.

At this point, it was originally felt that analysis of the data was complete, but close examination of Table 6 revealed that one firm, Firm 10, seemed to be producing unusual results. It exhibited the highest correct allocation rate on the basis of first probabilities, but lost most of its members on the basis of second probabilities, to Firm 4. As noted in the Results section, Firm 10 was unique in many ways, and so it was decided to investigate what effect Firm 10 was having on the results. The results of the reanalysis revealed that Firm 10 was improving the cohesiveness of the factorial solutions by reducing the number

of factors, and by causing the factors obtained to be "cleaner" i.e., to have fewer multiple factors. One factor was most affected by the removal of Firm 10 and that was the Experienced Psychological States factor. While it remained as a clearly defined factor, the sign on the loadings changed from negative to positive. This indicates that this factor had a strong negative relationship in Firm 10, sufficient to outweigh any positive relationships which may have existed in the other firms. Why this should be so is uncertain. The effect is particularly noticeable as the other factors show little evidence of change of sign on the loadings. Postulated causes would have to include those of sex and the nature of the jobs, the sex factor having the highest face validity. Without further analysis, however, focussed on Firm 10, a firm conclusion would be unwise.

The Multiple Discriminant Analysis (Table10) for the reduced sample reflected the poorer performance of the Job Diagnostic Survey found in the Factor Analysis. Evidence for this can be found in the lower correct allocation rates for first probabilities, while the higher correct allocation rate for second probabilities could be seen as due to a lower interchangeability between the firms left on the analysis.

The result of the reanalysis confirms the effect that sample constitution has on the Job Diagnostic Survey's ability to perform as designed, and also to confirm that the core dimensions are not as stable with different samples as would be desired. The reanalysis also confirmed the effect of Firm 10 on the results of the study, an effect which was a unifying one, as can be seen in the improved factor solution in Table 3 versus that seen in Table 8.

CHAPTER 6

CONCLUSION

The results of this study show that, in general, the New Zealand supervisor scores higher on the Job Diagnostic Survey than his United States counterpart, although there were at least three exceptions to this. It was also demonstrated that the Job Diagnostic Survey has some applicability to the New Zealand situation in that the results obtained from the New Zealand sample gave a profile of scores similar to that of the United States samples. The age and education figures also reveal some similarities to distribution, further supporting the thesis that the Job Diagnostic Survey could readily be used in New Zealand industry.

The issue of dimensionality of the Job Diagnostic Survey does not detract from the usefulness of the individual variables in being used in diagnostic and evaluation activities, although the use of the core dimensions in forming the Motivating Potential Score must be called into question. As Oldham Hackman and Stepina (p 40, 1978) point out, the changing dimensionality of the core dimensions has implications for the Motivating Potential Score measure. If a five factor solution had been obtained from the data, then the multiplicative Motivating Potential Score would be appropriate, since the calculation assumes the five dimensions to be empirically distinct. However, as fewer than five factors were obtained, then an additive measure may be best, and in fact has been found to be just as effective as the multiplicative measure, if not more so (Hackman and Oldham, 1976; Umstot et al, 1976). Putting aside the issue of which type of measure is more appropriate, the individual dimensions can still be used constructively in comparison, diagnostic and evaluation activities by using the means and standard deviations in the manner laid down by Oldham, Hackman and Stepina (p 41, 1978). This is probably the best use to which the Job Diagnostic Survey can be put.

The result which claims the most attention is that only three core dimensions are sufficient to explain the variance for New Zealand supervisors. This result brings into question the five core dimensions of Hackman and Lawler (1971) and Hackman and Oldham (1975), but is, at the same time, in agreement with previous workers (Dunham, 1976) who have found that three core dimensions are sufficient. One point which must be noted is that the number of core dimensions found depends to a large extent on the nature of the sample (Dunham, 1976; Dunham and Brief, 1977). This interaction between sample and dimension is not unexpected if one considers the nature of the dimensions. The scores on each dimension could be expected to change with different jobs, and hence, with different samples. The effect of this would be to change the interrelationships between the dimensions, which in turn would give rise to different factor solutions for the different samples.

There are two points which should be considered in relation to the question of dimensionality. The first is that the use of the term "core" in describing the dimensions is perhaps the greatest problem with Hackman and Lawler's concept, as it infers a constancy which has not been found to exist. The fact that this, and other studies have found three dimensions, and not five to give a more concise description of jobs denies the existence of any such constancy. The use of the terms job dimensions or job characteristics go some way to overcoming any inferred constancy, but do not overcome the inherent problem of dimensionality. The concept of dimensionality is also an area which causes problems, as it implies some empirical difference between the dimensions, but as Oldham, Hackman and Stepina (p40, 1978) point out, "there is no reason to expect that the job dimensions would or should be completely independent." This second point brings into question the whole issue of the dimensionality of both Hackman and Lawler's theory, and the Job Diagnostic Survey. If, as Oldham, et al (1978) claim, the dimensions are not in fact independent, then it is nonsensical to pursue the issue of how many job dimensions there are. However, Table 2 shows that although there are no independent dimensions for the United States sample, there are some for the New Zealand sample. This reveals a dependence on the sample on which the data is based, and confirms the findings of previous studies e.g. Dunham (1976). The fact that the dimensionality of the Job Diagnostic Survey remained virtually identical between the two analyses, supports the postulate that the nature of the sample being studied is of prime importance. A clear description of the nature of the samples of the previous studies may reveal a contributing factor to the variability of the job dimensions reported.

On the basis of the above points, the major conclusion of the study is that the first seven variables of the Job Diagnostic Survey summarize down to three dimensions, which can be summarized as an Autonomy dimension, a Task Significance dimension, and a Task Identity dimension, but that this result is only typical of the sample of New Zealand supervisors who participated in the study. There is no evidence that this particular solution will hold for other samples, either in New Zealand, or elsewhere. Perhaps the greatest implication of this study is that the Job Diagnostic Survey is not a consistent enough instrument to adequately test Hackman and Lawler's theory, or to settle the dimensionality argument.

The Job Diagnostic Survey does, however, have value in diagnostic and evaluation processes, as noted previously, and this is supported by the results obtained from the Multiple Discriminant Analyses. These results show clearly that there were differences between the firms tested, on the different variables (Tables 6 and 10). The reasonably high correct allocation rates are evidence of unique results for the individual firms, which means that, should a firm wish to use the Job Diagnostic Survey for diagnostic or evaluation purposes, it can be reasonably sure that the results will be typical of that firm, and unique to it.

This study has given some indication as to how New Zealand supervisors see their jobs, and how they see others interacting with them, and as such, could be a basis for further study. This is especially important if one considers that the education levels of the supervisors sampled is relatively poor. Further study of supervisors should reveal whether the education

levels are affecting the standards of supervision in New Zealand industry. Other fields of study could include supervision standards and their effect on industrial relations or, the use of the Job Diagnostic Survey to diagnose the supervisors' jobs, and relate the results to the incidence of industrial problems in the industries tested. It may be that the two issues are related in some way which has not hitherto been realised.

In summary, a number of points have arisen from this study. The first is that New Zealand supervisors have scores on the Job Diagnostic Survey which compare favourably with results obtained from United States samples. Secondly, the Job Diagnostic Survey is a consistent instrument on all the variables except the job dimensions, where it proves to be very sensitive to sample. On the basis of the results obtained, the four core dimensions of Hackman and Lawler (1972) and the five core dimensions of Hackman and Oldham (1975), reduce to three core dimensions, so failing to replicate these previous findings. The third point is that, despite the failing noted above, the Job Diagnostic Survey is still a reasonable instrument to use for diagnostic and evaluation purposes. Problems only seem to arise when it is used in an attempt to settle the question of dimensionality of the core dimensions.

ACKNOWLEDGEMENTS

I wish to thank Mr. B.D. Jamieson for his patience and perseverance throughout the long course of this thesis, and also for all his help.

I also wish to thank Prof. R.A.M. Gregson for his assistance with the statistical analyses.

Finally, I would like to thank the eleven Canterbury firms without whom this thesis would not have been possible.

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APPENDIX 1

Job dimensions. The JDS provides measures of the five core dimensions shown in Figure 1.

Skill Variety. The degree to which a job requires a variety of different activities in carrying out the work, which involve the use of a number of different skills and talents of the employee.

Task Identity. The degree to which the job requires completion of a "whole" and identifiable piece of work – i.e., doing a job from beginning to end with a visible outcome.

Task Significance. The degree to which the job has a substantial impact on the lives or work of other people – whether in the immediate organization or in the external environment.

Autonomy. The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out.

Feedback from the Job Itself. The degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance.

In addition, measures are obtained for two additional dimensions which have been found to be helpful in understanding jobs and employee reactions to them. These are:

Feedback from Agents. The degree to which the employee receives clear information about his or her performance from supervisors or from co-workers.

Dealing with Others. The degree to which the job requires the employee to work closely with other people in carrying out the work activities (including dealings with other organization members and with external organizational "clients.")

Critical psychological states. The JDS provides measures of each of the three psychological states which are shown in Figure 1 as mediating between the core job dimensions and the outcomes of the work. These are:

Experienced Meaningfulness of the Work. The degree to which the employee experiences the job as one which is generally meaningful, valuable, and worthwhile.

Experienced Responsibillity for Work Outcomes. The degree to which the employee

feels personally accountable and responsible for the results of the work he or she does.

Knowledge of Results. The degree to which the employee knows and understands, on a continuous basis, how effectively he or she is performing the job.

Personal outcomes. The JDS provides measures of a number of personal outcomes or reactions a person obtains from performing the job. These are:

General Satisfaction. An overall measure of the degree to which the employee is satisfied and happy with the job.

Internal Work Motivation. The degree to which the employee is self-motivated to perform effectively on the job -- i.e., the employee experiences positive internal feelings when working effectively on the job, and negative internal feelings when doing poorly.

Growth Satisfaction. The degree to which the employee is satisfied with opportunities for personal growth and development on the job.

Satisfaction with the work context. The JDS provides several measures of employees' satisfaction with the work context. Context satisfactions are expected to affect how positively an employee will respond to a job high on the core dimensions (see Figure 1). Satisfactions with four elements of the work context are measured:

(a) job security
(b) pay and other compensation
(c) peers and co-workers ("social satisfaction")
(d) supervision

Individual growth need strength. The JDS taps the strength of the respondent's desire to obtain "growth" satisfactions from his or her work. This measure is viewed as a malleable individual difference characteristic which (as shown in Figure 1) is predicted to affect how positively an employee will respond to a job with high motivating potential.

Growth need strength is measured in two separate sections of the instrument. In the "would like" section, respondents are asked to indicate the degree to which they would like several growth relevant conditions (e.g., opportunities to learn new things, opportunities to be creative and imaginative) present in their work. In the "job choice" section, respondents are asked to indicate their relative preferences for pairs of hypothetical jobs. In each item a job with characteristics relevant to growth need satisfaction is paired with a job which has the potential for satisfying one of a variety of other needs. Finally, scores derived from both of these sections are averaged to form a total growth need strength index.

APPENDIX 2

COMPUTER PRINTOUTS FOR

```
C
C     ******************************************************************
C
C        SAMPLE MAIN PROGRAM FOR FACTOR ANALYSIS - FACTO
C
C        PURPOSE
C           (1) READ THE PROBLEM PARAMETER CARD, (2) CALL FIVE SUBROU-
C           TINES TO PERFORM A PRINCIPAL COMPONENT SOLUTION AND THE
C           VARIMAX ROTATION OF A FACTOR MATRIX, AND (3) PRINT THE
C           RESULTS.
C
C        REMARKS
C           NONE
C
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
C           CORRE  (WHICH, IN TURN, CALLS THE SUBROUTINE NAMED DATA.)
C           EIGEN
C           TRACE
C           LLOAD
C           VARMX
C
C        METHOD
C           REFER TO 'BMD COMPUTER PROGRAMS MANUAL', EDITED BY W. J.
C           DIXON, UCLA, 1964.
C
C     ******************************************************************
C
C     THE FOLLOWING DIMENSIONS MUST BE GREATER THAN OR EQUAL TO THE
C     NUMBER OF VARIABLES, M.
C
      DIMENSION B(70),D(70),S(70),T(70),XBAR(70)
C
C     THE FOLLOWING DIMENSION MUST BE GREATER THAN OR EQUAL TO THE
C     PRODUCT OF M*M.
C
      DIMENSION V(5000)
C
C     THE FOLLOWING DIMENSION MUST BE GREATER THAN OR EQUAL TO
C     (M+1)*M/2.
C
      DIMENSION R(2500)
      DIMENSION X(2500)
C
C     THE FOLLOWING DIMENSION MUST BE GREATER THAN OR EQUAL TO 51.
C
```

```
FACTC0001  C   000100000150
FACTC0002  C   000100000150
FACTC0003  C   000100000150
FACTC0004  C   000100000150
FACTC0005  C   000100000150
FACTC0006  C   000100000150
FACTC0007  C   000100000150
FACTC0008  C   000100000150
FACTC0009  C   000100000150
FACTC0010  C   000100000150
FACTC0011  C   000100000150
FACTC0012  C   000100000150
FACTC0013  C   000100000150
FACTC0014  C   000100000150
FACTC0015  C   000100000150
FACTC0016  C   000100000150
FACTC0017  C   000100000150
FACTC0018  C   000100000150
FACTC0019  C   000100000150
FACTC0020  C   000100000150
FACTC0021  C   000100000150
FACTC0022  C   000100000150
FACTC0023  C   000100000150
FACTC0024  C   000100000150
FACTC0025  C   000100000150
FACTC0026  C   000100000150
FACTC0027  C   000100000150
FACTC0028  C   000100000150
FACTC0029  C   000100000150
FACTC0030  C   000100000150
                    START OF SEGMENT 002
               FORMAT SEGMENT IS 0003 LONG
                   C   002100000100
FACTC0032  C   002100000100
FACTC0033  C   002100000100
FACTC0034  C   002100000100
FACTC0035  C   002100000100
                   C   002100000100
FACTC0037  C   002100000100
FACTC0038  C   002100000100
FACTC0039  C   002100000100
FACTC0040  C   002100000100
                   C   002100000100
FACTC0042  C   002100000100
FACTC0043  C   002100000100
FACTC0044  C   002100000100
```

```
      DIMENSION TV(51)                                                  FACTC045   C   0021 0000 0
C                                                                       FACTC046   C   0021 0000 0
C     ****************************************************************  FACTC047   C   0021 0000 0
C                                                                       FACTC048   C   0021 0000 0
C        IF A DOUBLE PRECISION VERSION OF THIS ROUTINE IS DESIRED, THE  FACTC049   C   0021 0000 0
C        C IN COLUMN 1 SHOULD BE REMOVED FROM THE DOUBLE PRECISION      FACTC050   C   0021 0000 0
C        STATEMENT WHICH FOLLOWS.                                       FACTC051   C   0021 0000 0
C                                                                       FACTC052   C   0021 0000 0
C     DOUBLE PRECISION XBAR,S,V,R,D,B,T,TV                              FACTC053   C   0021 0000 0
C                                                                       FACTC054   C   0021 0000 0
C        THE C MUST ALSO BE REMOVED FROM DOUBLE PRECISION STATEMENTS    FACTC055   C   0021 0000 0
C        APPEARING IN OTHER ROUTINES USED IN CONJUNCTION WITH THIS      FACTC056   C   0021 0000 0
C        ROUTINE.                                                       FACTC057   C   0021 0000 0
C                                                                       FACTC058   C   0021 0000 0
C     ****************************************************************  FACTC059   C   0021 0000 0
    1 FORMAT(21H1FACTOR ANALYSIS.....A4,A2//3X,12HNO. OF CASES,4X,I6/3X,  FACTC060   C   0021 0000 0
     1 16HNO. OF VARIABLES,I6/)                                         FACTC061   C   0021 0000 0
    2 FORMAT(6HMEANS/(8F15.5))                                          FACTC062   C   0021 0000 0
    3 FORMAT(20HSTANDARD DEVIATIONS/(8F15.5))                           FACTC063   C   0021 0000 0
    4 FORMAT(25HCORRELATION COEFFICIENTS)                               FACTC064   C   0021 0000 0
    5 FORMAT(4HROW I3/(10F12.5))                                        FACTC065   C   0021 0000 0
    6 FORMAT(1H0/12H EIGENVALUES/(10F12.5))                             FACTC066   C   0021 0000 0
    7 FORMAT(37H0CUMULATIVE PERCENTAGE OF EIGENVALUES/(10F12.5))        FACTC067   C   0021 0000 0
    8 FORMAT(1H0/13H EIGENVECTORS)                                      FACTC068   C   0021 0000 0
    9 FORMAT(7HVECTOR I3/(10F12.5))                                     FACTC069   C   0021 0000 0
   10 FORMAT(1H0/16H FACTOR MATRIX (,I3,9H FACTORS))                    FACTC070   C   0021 0000 0
   11 FORMAT(9HVARIABLE I3/(10F12.5))                                   FACTC071   C   0021 0000 0
   12 FORMAT(1H0/10H ITERATION,7X,9HVARIANCES/8H   CYCLE)               FACTC072   C   0021 0000 0
   13 FORMAT(I6,F20.6)                                                  FACTC073   C   0021 0000 0
   14 FORMAT(1H0/24H ROTATED FACTOR MATRIX (I3,9H FACTORS))             FACTC074   C   0021 0000 0
   15 FORMAT(9HVARIABLE I3/(10F12.5))                                   FACTC075   C   0021 0000 0
   16 FORMAT(1H0/23H CHECK ON COMMUNALITIES//9H VARIABLE,7X,8HORIGINAL,1  FACTC076   C   0021 0000 0
     1 2X,5HFINAL,10X,10HDIFFERENCE)                                    FACTC077   C   0021 0000 0
   17 FORMAT(I6,3F18.5)                                                 FACTC078   C   0021 0000 0
   18 FORMAT(A4,A2,I5,I2,F6.0)                                          FACTC079   C   0021 0000 0
   19 FORMAT(5HONLY,I2,30H FACTOR RETAINED.  NO ROTATION)               FACTC080   C   0021 0000 0
C                                                                       FACTC081   C   0021 0000 0
C     ****************************************************************  FACTC082   C   0021 0000 0
C                                                                       FACTC083   C   0021 0000 0
C     READ PROBLEM PARAMETER CARD                                       FACTC084   C   0021 0000 0
C                                                                       FACTC085   C   0021 0000 0
      WRITE(6,300)                                                      FACTC086   C   0021 0000 0
                                                                        F 086 A        FIB IS 0006 LONG
  300 FORMAT(' ',T7,'MODIFIED PROGRAM, 70 VARIABLES AND DATA LIST'//    F 086 C    C   0021 0004 2
     1T7,'GREGSON PSYCHOLOGY DEPARTMENT 1975/77')
  100 READ (5,18,END=401) PR,PR1,N,M,CON                                FACTC087   C   0021 0004 2
                                                                                   FIB IS 0006 LONG
C        PR.........PROBLEM NUMBER (MAY BE ALPHAMERIC)                  FACTC088   C   0021 0014 0
C        PR1........PROBLEM NUMBER (CONTINUED)                          FACTC089   C   0021 0014 0
C        N..........NUMBER OF CASES                                     FACTC090   C   0021 0014 0
C        M..........NUMBER OF VARIABLES                                 FACTC091   C   0021 0014 0
C        CON........CONSTANT USED TO DECIDE HOW MANY EIGENVALUES        FACTC092   C   0021 0014 0
C                      TO RETAIN                                        FACTC093   C   0021 0014 0
C                                                                       FACTC094   C   0021 0014 0
      WRITE (6,1) PR,PR1,N,M                                            FACTC095   C   0021 001F 2
C                                                                       FACTC096   C   0021 001F 2
      IO=0                                                              FACTC097   C   0021 001F 2
      X(1) = 0.0                                                        FACTC098   C   0021 0020 0
C                                                                       FACTC099   C   0021 0021 0
      CALL CORRE (N,M,IO,X,XBAR,S,V,R,D,B,T)                            FACTC100   C   0021 0021 0
C                                                                       FACTC101   C   0021 0028 3
C     PRINT MEANS                                                       FACTC102   C   0021 0028 3
C                                                                       FACTC103   C   0021 0028 3
      WRITE (6,2) (XBAR(J),J=1,M)                                       FACTC104   C   0021 0028 3
C                                                                       FACTC105   C   0021 0034 2
C     PRINT STANDARD DEVIATIONS                                         FACTC106   C   0021 0034 2
C                                                                       FACTC107   C   0021 0034 2
      WRITE (6,3) (S(J),J=1,M)                                          FACTC108   C   0021 0034 2
C                                                                       FACTC109   C   0021 0040 2
C     PRINT CORRELATION COEFFICIENTS                                    FACTC110   C   0021 0040 2
C                                                                       FACTC111   C   0021 0040 2
      WRITE (6,4)                                                       FACTC112   C   0021 0040 2
      DO 120 I=1,M                                                      FACTC113   C   0021 0044 1
      DO 110 J=1,M                                                      FACTC114   C   0021 0045 0
      IF(I-J) 102, 104, 104                                             FACTC115   C   0021 0045 0
  102 L=I+(J*J-J)/2                                                     FACTC116   C   0021 0047 0
      GO TO 110                                                         FACTC117   C   0021 004A 1
  104 L=J+(I*I-I)/2                                                     FACTC118   C   0021 004A 1
  110 D(J)=R(L)                                                         FACTC119   C   0021 0040 3
  120 WRITE (6,5) I,(D(J),J=1,M)                                        FACTC120   C   0021 0052 3
C                                                                       FACTC121   C   0021 0061 3
      MV=0                                                              FACTC122   C   0021 0061 3
      CALL EIGEN (R,V,M,MV)                                             FACTC123   C   0021 0062 1
C                                                                       FACTC124   C   0021 0065 1
      CALL TRACE (M,R,CON,K,D)                                          FACTC125   C   0021 0065 1
```

```
C
C       PRINT EIGENVALUES                                                       FACT0126  C   002:0068:4
C                                                                               FACT0127  C   002:0068:4
        DO 130 I=1,K                                                            FACT0128  C   002:0068:4
        L=I+(I-1)/2                                                             FACT0129  C   002:0068:4
  130   S(I)=R(L)                                                               FACT0130  C   002:006A:0
        WRITE (6,6) (S(J),J=1,K)                                                FACT0131  C   002:006C:4
C                                                                               FACT0132  C   002:007:1:1
C       PRINT CUMULATIVE PERCENTAGE OF EIGENVALUES                              FACT0133  C   002:007D:2
C                                                                               FACT0134  C   002:007D:2
        WRITE (6,7) (D(J),J=1,K)                                                FACT0135  C   002:007D:2
C                                                                               FACT0136  C   002:007D:2
C       PRINT EIGENVECTORS                                                      FACT0137  C   002:0089:2
C                                                                               FACT0138  C   002:0089:2
        WRITE (6,8)                                                             FACT0139  C   002:0089:2
        L=0                                                                     FACT0140  C   002:0089:2
        DO 150 J=1,K                                                            FACT0141  C   002:008D:2
        DO 140 I=1,M                                                            FACT0142  C   002:008E:0
        L=L+1                                                                   FACT0143  C   002:008F:0
  140   D(I)=V(L)                                                               FACT0144  C   002:0090:0
  150   WRITE (6,9) J,(D(I),I=1,M)                                              FACT0145  C   002:0091:2
C                                                                               FACT0146  C   002:0095:5
        CALL LOAD (M,K,R,V)                                                     FACT0147  C   002:00A3:3
C                                                                               FACT0148  C   002:00A5:3
C       PRINT FACTOR MATRIX                                                     FACT0149  C   002:00AD:3
C                                                                               FACT0150  C   002:00AD:3
        WRITE (6,10) K                                                          FACT0151  C   002:00AD:3
        DO 180 I=1,M                                                            FACT0152  C   002:00AD:3
        DO 170 J=1,K                                                            FACT0153  C   002:00AF:2
        L=M*(J-1)+I                                                             FACT0154  C   002:00B0:0
  170   D(J)=V(L)                                                               FACT0155  C   002:00B1:0
  180   WRITE (6,11) I,(D(J),J=1,K)                                             FACT0156  C   002:00D3:2
C                                                                               FACT0157  C   002:00E7:5
        IF(K-1) 185, 185, 188                                                   FACT0158  C   002:00C7:3
  185   WRITE (6,19) K                                                          FACT0159  C   002:00C7:3
        GO TO 100                                                               FACT0160  C   002:00C8:4
C                                                                               FACT0161  C   002:00CF:2
  188   CALL VARMX (M,K,V,NC,TV,B,T,D)                                          FACT0162  C   002:00CF:5
C                                                                               FACT0163  C   002:00CF:5
C       PRINT VARIANCES                                                         FACT0164  C   002:00D5:2
C                                                                               FACT0165  C   002:00D5:2
        NV=NC+1                                                                 FACT0166  C   002:00D5:2
        WRITE (6,12)                                                            FACT0167  C   002:00D5:2
        DO 190 I=1,NV                                                           FACT0168  C   002:00D8:4
        NC=I-1                                                                  FACT0169  C   002:00DA:2
  190   WRITE (6,13) NC,TV(I)                                                   FACT0170  C   002:00DB:0
C                                                                               FACT0171  C   002:00DC:2
C       PRINT ROTATED FACTOR MATRIX                                             FACT0172  C   002:00E7:3
C                                                                               FACT0173  C   002:00E7:3
        WRITE (6,14) K                                                          FACT0174  C   002:00E7:3
        DO 220 I=1,M                                                            FACT0175  C   002:00E7:3
        DO 210 J=1,K                                                            FACT0176  C   002:00EE:2
        L=M*(J-1)+I                                                             FACT0177  C   002:00EF:0
  210   S(J)=V(L)                                                               FACT0178  C   002:00F0:0
  220   WRITE (6,15) I,(S(J),J=1,K)                                             FACT0179  C   002:00F2:2
C                                                                               FACT0180  C   002:00F8:3
C       PRINT COMMUNALITIES                                                     FACT0181  C   002:0100:3
C                                                                               FACT0182  C   002:0100:3
        WRITE (6,16)                                                            FACT0183  C   002:0100:3
        DO 230 I=1,M                                                            FACT0184  C   002:0120:3
  230   WRITE (6,17) I,B(I),T(I),D(I)                                           FACT0185  C   002:012A:2
        GO TO 100                                                               FACT0186  C   002:012B:0
  401   CONTINUE                                                                          C   002:011A:3
        END                                                                     FACT0188  C   002:011B:0
        002:011E:2  IS THE LOCATION FOR EXCEPTIONAL ACTION ON THE I/O STATEMENT AT FACT0087
                                                        SEGMENT 002 IS 0142 LONG
```

```
C
C     ******************************************************************
C
C        SAMPLE INPUT SUBROUTINE - DATA
C
C        PURPOSE
C           READ AN OBSERVATION (M DATA VALUES) FROM INPUT DEVICE.
C           THIS SUBROUTINE IS CALLED BY THE SUBROUTINE CORRE AND MUST
C           BE PROVIDED BY THE USER.  IF SIZE AND LOCATION OF DATA
C           FIELDS ARE DIFFERENT FROM PROBLEM TO PROBLEM, THIS SUB-
C           ROUTINE MUST BE RECOMPILED WITH A PROPER FORMAT STATEMENT.
C
C        USAGE
C           CALL DATA (M,D)
C
C        DESCRIPTION OF PARAMETERS
C           M - THE NUMBER OF VARIABLES IN AN OBSERVATION.
C           D - OUTPUT VECTOR OF LENGTH M CONTAINING THE OBSERVATION
C               DATA.
C
C        REMARKS
C           THE TYPE OF CONVERSION SPECIFIED IN THE FORMAT MUST BE
C           EITHER F OR E.
C
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
C           NONE
C     ******************************************************************
      SUBROUTINE DATA (M,D)
      DIMENSION D(1)
C
C     VARIABLE FORMAT INPUT CARD.....
    1 FORMAT(10F6.2/10F6.2)
C
C     READ AN OBSERVATION FROM INPUT DEVICE.
      READ (5,1) (D(I),I=1,M)
      WRITE(6,2021)(D(I),I=1,M)
 2021 FORMAT(' ',(T4,16F6.1))
C
      RETURN
      END
```

```
DATA 001   C   002:014210
DATA 002   C   002:014210
DATA 003   C   002:014210
DATA 004   C   002:014210
DATA 005   C   002:014210
DATA 006   C   002:014210
DATA 007   C   002:014210
DATA 008   C   002:014210
DATA 009   C   002:014210
DATA 010   C   002:014210
DATA 011   C   002:014210
DATA 012   C   002:014210
DATA 013   C   002:014210
DATA 014   C   002:014210
DATA 015   C   002:014210
DATA 016   C   002:014210
DATA 017   C   002:014210
DATA 018   C   002:014210
DATA 019   C   002:014210
DATA 020   C   002:014210
DATA 021   C   002:014210
DATA 022   C   002:014210
DATA 023   C   002:014210
DATA 024   C   002:014210
DATA 025   C   002:014210
DATA 026   C   002:014210
DATA 027   C   002:014210
DATA 028   C   002:014210
                    START OF SEGMENT 006
DATA 029   C   006:000010
DATA 030   C   006:000010
DATA 031   C   006:000010
DATA 032   C   006:000010
           C   006:000010
           C   006:000010
           C   006:000010
           C   006:000010
DATA 034   C   006:000010
DATA 035   C   006:000010
DATA 036   C   006:000010
DATA 037   C   006:000010
  D 037A   C   006:000012
  D 037B   C   006:001A12
DATA 038   C   006:001A12
DATA 039   C   006:001A12
DATA 040   C   006:001A15
                SEGMENT 006 IS 0024 LONG
```

```
C     ******************************************************************  CORRE001   C   006:002410
C                                                                          CORRE002   C   006:002410
C        SUBROUTINE CORRE                                                  CORRE003   C   006:002410
C                                                                          CORRE004   C   006:002410
C        PURPOSE                                                           CORRE005   C   006:002410
C           COMPUTE MEANS, STANDARD DEVIATIONS, SUMS OF CROSS-PRODUCTS     CORRE006   C   006:002410
C           OF DEVIATIONS, AND CORRELATION COEFFICIENTS.                   CORRE007   C   006:002410
C                                                                          CORRE008   C   006:002410
C                                                                          CORRE009   C   006:002410
C        USAGE                                                             CORRE010   C   006:002410
C           CALL CORRE (N,M,IO,X,XBAR,STD,RX,R,B,D,T)                      CORRE011   C   006:002410
C                                                                          CORRE012   C   006:002410
C        DESCRIPTION OF PARAMETERS                                         CORRE013   C   006:002410
C           N      - NUMBER OF OBSERVATIONS.                                 CORRE0     C   006:002410
C           M      - NUMBER OF VARIABLES.                                  CORRE015   C   006:002410
C           IO     - OPTION CODE FOR INPUT DATA                            CORRE016   C   006:002410
C                    0 IF DATA ARE TO BE READ IN FROM INPUT DEVICE IN THE   CORRE017   C   006:002410
C                      SPECIAL SUBROUTINE NAMED DATA.  (SEE SUBROUTINES     CORRE018   C   006:002410
C                      USED BY THIS SUBROUTINE BELOW.)                      CORRE019   C   006:002410
C                    1 IF ALL DATA ARE ALREADY IN CORE.                     CORRE020   C   006:002410
C           X      - IF IO=0, THE VALUE OF X IS 0.0.                       CORRE021   C   006:002410
C                    IF IO=1, X IS THE INPUT MATRIX (N BY M) CONTAINING     CORRE022   C   006:002410
C                      DATA.                                                CORRE023   C   006:002410
C           XBAR   - OUTPUT VECTOR OF LENGTH M CONTAINING MEANS.           CORRE024   C   006:002410
C           STD    - OUTPUT VECTOR OF LENGTH M CONTAINING STANDARD         CORRE025   C   006:002410
C                    DEVIATIONS.                                          CORRE026   C   006:002410
C           RX     - OUTPUT MATRIX (M X M) CONTAINING SUMS OF CROSS-       CORRE027   C   006:002410
C                    PRODUCTS OF DEVIATIONS FROM MEANS.                   CORRE028   C   006:002410
C           R      - OUTPUT MATRIX (ONLY UPPER TRIANGULAR PORTION OF THE   CORRE029   C   006:002410
C                    SYMMETRIC MATRIX OF M BY M) CONTAINING CORRELATION    CORRE030   C   006:002410
C                    COEFFICIENTS.  (STORAGE MODE OF 1)                    CORRE031   C   006:002410
C           B      - OUTPUT VECTOR OF LENGTH M CONTAINING THE DIAGONAL     CORRE032   C   006:002410
C                    OF THE MATRIX OF SUMS OF CROSS-PRODUCTS OF            CORRE033   C   006:002410
C                    DEVIATIONS FROM MEANS.                                CORRE034   C   006:002410
C           D      - WORKING VECTOR OF LENGTH M.                           CORRE035   C   006:002410
C           T      - WORKING VECTOR OF LENGTH M.                           CORRE036   C   006:002410
C                                                                          CORRE037   C   006:002410
C        REMARKS                                                           CORRE038   C   006:002410
C           N MUST BE GREATER THAN OR EQUAL TO M.                          CORRE039   C   006:002410
C                                                                          CORRE040   C   006:002410
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED                     CORRE041   C   006:002410
C           DATA(M,D) - THIS SUBROUTINE MUST BE PROVIDED BY THE USER.      CORRE042   C   006:002410
C                       (1) IF IO=0, THIS SUBROUTINE IS EXPECTED TO        CORRE043   C   006:002410
C                           FURNISH AN OBSERVATION IN VECTOR D FROM AN     CORRE044   C   006:002410
C                           EXTERNAL INPUT DEVICE.                         CORRE045   C   006:002410
C                       (2) IF IO=1, THIS SUBROUTINE IS NOT USED BY        CORRE046   C   006:002410
C                           CORRE BUT MUST EXIST IN JOB DECK.  IF USER     CORRE047   C   006:002410
C                           HAS NOT SUPPLIED A SUBROUTINE NAMED DATA,      CORRE048   C   006:002410
C                           THE FOLLOWING IS SUGGESTED.                    CORRE049   C   006:002410
C                                 SUBROUTINE DATA                            CORRE0     C   006:002410
C                                 RETURN                                   CORRE051   C   006:002410
C                                 END                                      CORRE052   C   006:002410
C                                                                          CORRE053   C   006:002410
C        METHOD                                                            CORRE054   C   006:002410
C           PRODUCT-MOMENT CORRELATION COEFFICIENTS ARE COMPUTED.          CORRE055   C   006:002410
C                                                                          CORRE056   C   006:002410
C     ******************************************************************  CORRE057   C   006:002410
C     ******************************************************************  CORRE058   C   006:002410
C                                                                                 START OF SEGMENT 007
      SUBROUTINE CORRE (N,M,IO,X,XBAR,STD,RX,R,B,D,T)                      CORRE059   C   007:000010
      DIMENSION X(2500),XBAR(1),STD(1),RX(1),R(1),B(1),D(1),T(1)           CORRE060   C   007:000010
      X(1) = 0.0                                                                     007:000010
C                                                                          CORRE061   C   007:000111
C     ******************************************************************  CORRE062   C   007:000111
C                                                                          CORRE063   C   007:000111
C        IF A DOUBLE PRECISION VERSION OF THIS ROUTINE IS DESIRED, THE     CORRE064   C   007:000111
C        C IN COLUMN 1 SHOULD BE REMOVED FROM THE DOUBLE PRECISION         CORRE065   C   007:000111
C        STATEMENT WHICH FOLLOWS.                                          CORRE066   C   007:000111
C                                                                          CORRE067   C   007:000111
C     DOUBLE PRECISION XBAR,STD,RX,R,B,T                                   CORRE068   C   007:000111
C                                                                          CORRE069   C   007:000111
C        THE C MUST ALSO BE REMOVED FROM DOUBLE PRECISION STATEMENTS       CORRE070   C   007:000111
C        APPEARING IN OTHER ROUTINES USED IN CONJUNCTION WITH THIS         CORRE071   C   007:000111
C        ROUTINE.                                                          CORRE072   C   007:000111
C                                                                          CORRE073   C   007:000111
C        THE DOUBLE PRECISION VERSION OF THIS SUBROUTINE MUST ALSO         CORRE074   C   007:000111
C        CONTAIN DOUBLE PRECISION FORTRAN FUNCTIONS.  SQRT AND ABS IN      CORRE075   C   007:000111
C        STATEMENT 220 MUST BE CHANGED TO DSQRT AND DABS.                  CORRE076   C   007:000111
```

```
C     ******************************************************************
C
C     INITIALIZATION
C
      DO 100 J=1,M
      B(J)=0.0
  100 T(J)=0.0
      K=(M+M+1)/2
      DO 102 I=1,K
  102 R(I)=0.0
      FN=N
      L=0
C
      IF(IQ) 105, 127, 105
C
C     DATA ARE ALREADY IN CORE
C
  105 DO 108 J=1,M
      DO 107 I=1,N
      L=L+1
  107 T(J)=T(J)+X(L)
      XBAR(J)=T(J)
  108 T(J)=T(J)/FN
C
      DO 115 I=1,N
      JK=0
      L=I-N
      DO 110 J=1,M
      L=L+N
      D(J)=X(L)-T(J)
  110 B(J)=B(J)+D(J)
      DO 115 J=1,M
      DO 115 K=1,J
      JK=JK+1
  115 R(JK)=R(JK)+D(J)*D(K)
      GO TO 205
C
C     READ OBSERVATIONS AND CALCULATE TEMPORARY
C     MEANS FROM THESE DATA IN T(J)
C
  127 IF(N-M) 130, 130, 135
  130 KK=N
      GO TO 137
  135 KK=M
  137 DO 140 I=1,KK
      CALL DATA (M,D)
      DO 140 J=1,M
      T(J)=T(J)+D(J)
      L=L+1
  140 RX(L)=D(J)
      FKK=KK
      DO 150 J=1,M
      XBAR(J)=T(J)
  150 T(J)=T(J)/FKK
C
C     CALCULATE SUMS OF CROSS-PRODUCTS OF DEVIATIONS
C     FROM TEMPORARY MEANS FOR M OBSERVATIONS
C
      L=0
      DO 180 I=1,KK
      JK=0
      DO 170 J=1,M
      L=L+1
  170 D(J)=RX(L)-T(J)
      DO 180 J=1,M
      B(J)=B(J)+D(J)
      DO 180 K=1,J
      JK=JK+1
  180 R(JK)=R(JK)+D(J)*D(K)
C
      IF(N-KK) 205, 205, 185
C
C     READ THE REST OF OBSERVATIONS ONE AT A TIME, SUM
C     THE OBSERVATIONS, AND CALCULATE SUMS OF CROSS-
C     PRODUCTS OF DEVIATIONS FROM TEMPORARY MEANS
C
  185 KK=N-KK
      DO 200 I=1,KK
      JK=0
      CALL DATA (M,D)
      DO 190 J=1,M
      XBAR(J)=XBAR(J)+D(J)
      D(J)=D(J)-T(J)
  190 B(J)=B(J)+D(J)
      DO 200 J=1,M
```

```
CORRE077  C  007:0001!1
CORRE078  C  007:0001!1
CORRE079  C  007:0001!1
CORRE080  C  007:0001!1
CORRE081  C  007:0001!1
CORRE082  C  007:0001!1
CORRE083  C  007:0002!0
CORRE084  C  007:0004!0
CORRE085  C  007:0009!1
CORRE086  C  007:000A!3
CORRE0    C  007:000C!0
CORRE088  C  007:0010!1
CORRE089  C  007:0011!0
CORRE090  C  007:0011!4
CORRE091  C  007:0011!4
CORRE092  C  007:0013!2
CORRE093  C  007:0013!2
CORRE094  C  007:0013!2
CORRE095  C  007:0015!2
CORRE096  C  007:0014!0
CORRE097  C  007:0015!0
CORRE098  C  007:0016!2
CORRE099  C  007:001C!2
CORRE100  C  007:001F!4
CORRE101  C  007:0024!3
CORRE102  C  007:0024!3
CORRE103  C  007:0026!0
CORRE104  C  007:0026!4
CORRE105  C  007:0028!1
CORRE106  C  007:0029!0
CORRE107  C  007:002A!3
CORRE108  C  007:002F!3
CORRE109  C  007:0035!3
CORRE110  C  007:0037!0
CORRE111  C  007:0038!0
CORRE112  C  007:0039!2
CORRE113  C  007:0045!2
CORRE114  C  007:0045!5
CORRE115  C  007:0045!5
CORRE116  C  007:0045!5
CORRE117  C  007:0045!5
CORRE118  C  007:0045!5
CORRE119  C  007:0047!1
CORRE120  C  007:0048!0
CORRE121  C  007:0048!3
CORRE122  C  007:0049!2
CORRE123  C  007:004A!0
CORRE124  C  007:004C!0
CORRE125  C  007:004D!0
CORRE126  C  007:0050!5
CORRE127  C  007:0052!1
CORRE128  C  007:0059!5
CORRE129  C  007:005A!4
CORRE130  C  007:005C!0
CORRE131  C  007:005F!2
CORRE132  C  007:0064!1
CORRE133  C  007:0064!1
CORRE134  C  007:0064!1
CORRE135  C  007:0064!1
CORRE136  C  007:0064!1
CORREM06  C  007:0064!5
CORRE138  C  007:0066!0
CORRE139  C  007:0066!4
CORRE140  C  007:0065!0
CORRE141  C  007:0069!2
CORRE142  C  007:0070!3
CORRE143  C  007:0072!0
CORRE144  C  007:0075!5
CORRE145  C  007:0077!0
CORRE146  C  007:0078!2
CORRE147  C  007:0084!2
CORRE148  C  007:0084!2
CORRE149  C  007:0086!1
CORRE150  C  007:0086!1
CORRE151  C  007:0086!1
CORRE152  C  007:0086!1
CORRE153  C  007:0086!1
CORRE154  C  007:0086!1
CORRE155  C  007:0097!4
CORRE156  C  007:0089!0
CORRE157  C  007:0089!4
CORRE158  C  007:008B!4
CORRE159  C  007:008D!2
CORRE160  C  007:0090!5
CORRE161  C  007:0094!4
CORRE162  C  007:0096!4
CORRE163  C  007:0096!0
```

```
      30 IA=I+(J*J-J)/2
         ANORM=ANORM+A(IA)*A(IA)
      35 CONTINUE
         IF(ANORM) 165,165,40
      40 ANORM=1.414* SQRT(ANORM)
         ANRMX=ANORM*RANGE/FLOAT(N)
C
C        INITIALIZE INDICATORS AND COMPUTE THRESHOLD, THR
C
         IND=0
         THR=ANORM
      45 THR=THR/FLOAT(N)
      50 L=1
      55 M=L+1
C
C        COMPUTE SIN AND COS
C
      60 MQ=(M*M-M)/2
         LQ=(L*L-L)/2
         LM=L+MQ
      62 IF( ABS(A(LM))-THR) 130,65,65
      65 IND=1
         LL=L+LQ
         MM=M+MQ
         X=0.5*(A(LL)-A(MM))
      68 Y=-A(LM)/ SQRT(A(LM)*A(LM)+X*X)
         IF(X) 70,75,75
      70 Y=-Y
      75 SINX=Y/ SQRT(2.0*(1.0+( SQRT(1.0-Y*Y))))
         SINX2=SINX*SINX
      78 COSX= SQRT(1.0-SINX2)
         COSX2=COSX*COSX
         SINCS =SINX*COSX
C
C        ROTATE L AND M COLUMNS
C
         ILQ=N*(L-1)
         IMQ=N*(M-1)
         DO 125 I=1,N
         IQ=(I*I-I)/2
         IF(I-L) 80,115,80
      80 IF(I-M) 85,115,90
      85 IM=I+MQ
         GO TO 95
      90 IM=M+IQ
      95 IF(I-L) 100,105,105
     100 IL=I+LQ
         GO TO 110
     105 IL=L+IQ
     110 X=A(IL)*COSX-A(IM)*SINX
         A(IM)=A(IL)*SINX+A(IM)*COSX
         A(IL)=X
     115 IF(MV-1) 120,125,120
     120 ILR=ILQ+I
         IMR=IMQ+I
         X=R(ILR)*COSX-R(IMR)*SINX
         R(IMR)=R(ILR)*SINX+R(IMR)*COSX
         R(ILR)=X
     125 CONTINUE
         X=2.0*A(LM)*SINCS
         Y=A(LL)*COSX2+A(MM)*SINX2-X
         X=A(LL)*SINX2+A(MM)*COSX2+X
         A(LM)=(A(LL)-A(MM))*SINCS+A(LM)*(COSX2-SINX2)
         A(LL)=Y
         A(MM)=X
C
C        TESTS FOR COMPLETION
C
C        TEST FOR M = LAST COLUMN
C
     130 IF(M-N) 135,140,135
     135 M=M+1
         GO TO 60
C
C        TEST FOR L = SECOND FROM LAST COLUMN
C
     140 IF(L-(N-1)) 145,150,145
     145 L=L+1
         GO TO 55
     150 IF(IND-1) 160,155,160
     155 IND=0
         GO TO 50
C
C        COMPARE THRESHOLD WITH FINAL NORM
C
     160 IF(THR-ANRMX) 165,165,45
```

```
EIGEN084  C  009100016F1
EIGEN085  C  009100001F12
EIGEN086  C  009100023F4
EIGEN087  C  009100024F5
EIGEN005  C  009100027F4
EIGEN089  C  009100029F1
EIGEN090  C  009100029F1
EIGEN091  C  009100029F1
EIGEN092  C  009100029F1
EIGEN093  C  009100029F5
EIGEN094  C  009100029A14
EIGEN095  C  009100029C10
EIGEN096  C  009100029C14
EIGEN097  C  009100029E10
EIGEN098  C  009100029E10
EIGEN099  C  009100029E10
EIGEN100  C  009100029E10
EIGEN101  C  009100030F2
EIGEN102  C  009100032A4
EIGEN103  C  009100034F1
EIGEN104  C  009100037F0
EIGEN105  C  009100037F4
EIGEN106  C  009100039F1
EIGEN107  C  009100039A14
EIGEN108  C  009100039F15
EIGEN109  C  009100046F5
EIGEN110  C  009100048F0
EIGEN111  C  009100049F0
EIGEN112  C  009100040F1
EIGEN113  C  009100040F10
EIGEN114  C  009100040F15
EIGEN115  C  009100050A4
EIGEN116  C  009100052F0
EIGEN117  C  009100052F0
EIGEN118  C  009100052F0
EIGEN119  C  009100052F0
EIGEN120  C  009100053F5
EIGEN121  C  009100055A4
EIGEN122  C  009100057F0
EIGEN123  C  009100059F2
EIGEN124  C  009100059A14
EIGEN125  C  009100059E10
EIGEN126  C  009100059F13
EIGEN127  C  009100060F0
EIGEN128  C  009100061F3
EIGEN129  C  009100062F5
EIGEN130  C  009100064F2
EIGEN131  C  009100064F5
EIGEN132  C  009100066F2
EIGEN133  C  009100068F0
EIGEN134  C  009100066F15
EIGEN135  C  009100072F0
EIGEN136  C  009100073F1
EIGEN137  C  009100074F4
EIGEN138  C  009100076F1
EIGEN139  C  009100077A15
EIGEN140  C  009100077F4
EIGEN141  C  009100081F5
EIGEN142  C  009100084F0
EIGEN143  C  009100087F0
EIGEN144  C  009100088C11
EIGEN145  C  009100091F3
EIGEN146  C  009100098F2
EIGEN147  C  009100093A13
EIGEN148  C  009100096C14
EIGEN149  C  009100096C14
EIGEN150  C  009100096C14
EIGEN151  C  009100096C14
EIGEN152  C  009100096C14
EIGEN153  C  009100096C14
EIGEN154  C  009100096E10
EIGEN155  C  009100096F12
EIGEN156  C  009100096F15
EIGEN157  C  009100096F15
EIGEN158  C  009100096F15
EIGEN159  C  009100096F15
EIGEN160  C  009100041F3
EIGEN161  C  009100042F5
EIGEN162  C  009100043F2
EIGEN163  C  009100044F3
EIGEN164  C  009100045F1
EIGEN167  C  009100045F4
EIGEN166  C  009100045F4
EIGEN165  C  009100045F4
EIGEN168  C  009100045F4
```

```
C                                                                       EIGEN001   C  007101000
C     ******************************************************************EIGEN002   C  007101000
C        SUBROUTINE EIGEN                                               EIGEN003   C  007101000
C                                                                       EIGEN004   C  007101000
C        PURPOSE                                                        EIGEN005   C  007101000
C           COMPUTE EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC     EIGEN006   C  007101000
C           MATRIX                                                      EIGEN007   C  007101000
C                                                                       EIGEN008   C  007101000
C        USAGE                                                          EIGEN009   C  007101000
C           CALL EIGEN(A,R,N,MV)                                        EIGEN010   C  007101000
C                                                                       EIGEN011   C  007101000
C        DESCRIPTION OF PARAMETERS                                      EIGEN012   C  007101000
C           A - ORIGINAL MATRIX (SYMMETRIC), DESTROYED IN COMPUTATION.  EIGEN013   C  007101000
C               RESULTANT EIGENVALUES ARE DEVELOPED IN DIAGONAL OF      EIGEN014   C  007101000
C               MATRIX A IN DESCENDING ORDER.                           EIGEN015   C  007101000
C           R - RESULTANT MATRIX OF EIGENVECTORS (STORED COLUMNWISE,     EIGEN016   C  007101000
C               IN SAME SEQUENCE AS EIGENVALUES)                        EIGEN017   C  007101000
C           N - ORDER OF MATRICES A AND R                               EIGEN018   C  007101000
C           MV- INPUT CODE                                              EIGEN019   C  007101000
C                     0   COMPUTE EIGENVALUES AND EIGENVECTORS          EIGEN020   C  007101000
C                     1   COMPUTE EIGENVALUES ONLY (R NEED NOT BE       EIGEN021   C  007101000
C                         DIMENSIONED BUT MUST STILL APPEAR IN CALLING  EIGEN022   C  007101000
C                         SEQUENCE)                                     EIGEN023   C  007101000
C                                                                       EIGEN024   C  007101000
C        REMARKS                                                        EIGEN025   C  007101000
C           ORIGINAL MATRIX A MUST BE REAL SYMMETRIC (STORAGE MODE=1)   EIGEN026   C  007101000
C           MATRIX A CANNOT BE IN THE SAME LOCATION AS MATRIX R         EIGEN027   C  007101000
C                                                                       EIGEN028   C  007101000
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED                  EIGEN029   C  007101000
C           NONE                                                        EIGEN030   C  007101000
C                                                                       EIGEN031   C  007101000
C        METHOD                                                         EIGEN032   C  007101000
C           DIAGONALIZATION METHOD ORIGINATED BY JACOBI AND ADAPTED     EIGEN033   C  007101000
C           BY VON NEUMANN FOR LARGE COMPUTERS AS FOUND IN 'MATHEMATICAL EIGEN034   C  007101000
C           METHODS FOR DIGITAL COMPUTERS', EDITED BY A. RALSTON AND    EIGEN035   C  007101000
C           H.S. WILF, JOHN WILEY AND SONS, NEW YORK, 1962, CHAPTER 7   EIGEN036   C  007101000
C                                                                       EIGEN037   C  007101000
C     ******************************************************************EIGEN038   C  007101000
C                                                                       EIGEN039   C  007101000
C                                                                       EIGEN040   C  007101000
                                                                                    START OF SEGMENT 0C9
      SUBROUTINE EIGEN(A,R,N,MV)                                        EIGEN041   C  009100000
      DIMENSION A(1),R(1)                                               EIGEN042   C  009100000
C                                                                       EIGEN043   C  009100000
C     ******************************************************************EIGEN044   C  009100000
C                                                                       EIGEN045   C  009100000
C        IF A DOUBLE PRECISION VERSION OF THIS ROUTINE IS DESIRED, THE  EIGEN046   C  009100000
C        C IN COLUMN 1 SHOULD BE REMOVED FROM THE DOUBLE PRECISION      EIGEN047   C  009100000
C        STATEMENT WHICH FOLLOWS.                                       EIGEN048   C  009100000
C                                                                       EIGEN049   C  009100000
C     DOUBLE PRECISION A,R,ANORM,ANRMX,THR,X,Y,SINX,SINX2,COSX,         EIGEN050   C  009100000
C    1                 COSX2,SINCS,RANGE                                EIGEN051   C  009100000
C                                                                       EIGEN052   C  009100000
C        THE C MUST ALSO BE REMOVED FROM DOUBLE PRECISION STATEMENTS    EIGEN053   C  009100000
C        APPEARING IN OTHER ROUTINES USED IN CONJUNCTION WITH THIS      EIGEN054   C  009100000
C        ROUTINE.                                                       EIGEN055   C  009100000
C                                                                       EIGEN056   C  009100000
C        THE DOUBLE PRECISION VERSION OF THIS SUBROUTINE MUST ALSO      EIGEN057   C  009100000
C        CONTAIN DOUBLE PRECISION FORTRAN FUNCTIONS.  SQRT IN STATEMENTS EIGEN058   C  009100000
C        40, 68, 75, AND 78 MUST BE CHANGED TO DSQRT.  ABS IN STATEMENT  EIGEN059   C  009100000
C        62 MUST BE CHANGED TO DABS. THE CONSTANT IN STATEMENT 5 SHOULD  EIGEN060   C  009100000
C        BE CHANGED TO 1.0D-12.                                         EIGEN061   C  009100000
C                                                                       EIGEN062   C  009100000
C     ******************************************************************EIGEN063   C  009100000
C        GENERATE IDENTITY MATRIX                                       EIGEN064   C  009100000
C                                                                       EIGEN065   C  009100000
    5 RANGE=1.0E-6                                                      EIGEN066   C  009100023
      IF(MV-1) 10,25,10                                                 EIGEN067   C  009100034
   10 IQ=-N                                                             EIGEN068   C  009100045
      DO 20 J=1,N                                                       EIGEN069   C  009100056
      IQ=IQ+N                                                           EIGEN070   C  009100067
      DO 20 I=1,N                                                       EIGEN071   C  009100078
      IJ=IQ+I                                                           EIGEN072   C  009100089
      R(IJ)=0.0                                                         EIGEN073   C  009100101
      IF(I-J) 20,15,20                                                  EIGEN074   C  009100113
   15 R(IJ)=1.0                                                         EIGEN075   C  009100124
   20 CONTINUE                                                          EIGEN076   C  009100135
C                                                                       EIGEN077   C  009100145
C        COMPUTE INITIAL AND FINAL NORMS (ANORM AND ANORMX)             EIGEN078   C  009100155
C                                                                       EIGEN079   C  009100155
   25 ANORM=0.0                                                         EIGEN080   C  009100155
      DO 35 I=1,N                                                       EIGEN081   C  009100166
      DO 35 J=1,N                                                       EIGEN082   C  009100177
      IF(I-J) 30,35,30                                                  EIGEN083   C  009100188
```

```
      DO 200 K=1,J
      JK=JK+1
  200 R(JK)=R(JK)+D(J)*D(K)
C
C     CALCULATE MEANS
C
  205 JK=0
      DO 210 J=1,M
      XBAR(J)=XBAR(J)/FN
C
C     ADJUST SUMS OF CROSS-PRODUCTS OF DEVIATIONS
C     FROM TEMPORARY MEANS
C
      DO 210 K=1,J
      JK=JK+1
  210 R(JK)=R(JK)-B(J)*B(K)/FN
C
C     CALCULATE CORRELATION COEFFICIENTS
C
      JK=0
      DO 220 J=1,M
      JK=JK+J
  220 STD(J)= SQRT( ABS(R(JK)))
      DO 230 J=1,M
      DO 230 K=J,M
      JK=J+(K*K-K)/2
      L=M*(J-1)+K
      RX(L)=R(JK)
      L=M*(K-1)+J
      RX(L)=R(JK)
      IF(STD(J)*STD(K)) 225, 222, 225
  222 R(JK)=0.0
      GO TO 230
  225 R(JK)=R(JK)/(STD(J)*STD(K))
  230 CONTINUE
C
C     CALCULATE STANDARD DEVIATIONS
C
      FN=SQRT(FN-1.0)
      DO 240 J=1,M
  240 STD(J)=STD(J)/FN
C
C     COPY THE DIAGONAL OF THE MATRIX OF SUMS OF CROSS-PRODUCTS OF
C     DEVIATIONS FROM MEANS.
C
      L=M
      DO 250 I=1,M
      L=L+M+1
  250 B(I)=RX(L)
      RETURN
      END
```

```
CORRE163   C   007:009C:0
CORRE164   C   007:009D:0
CORRE165   C   007:009E:2
CORRE166   C   007:00AA:2
CORRE167   C   007:00AA:2
CORRE168   C   007:00AA:2
CORRE169   C   007:00AA:2
CORRE170   C   007:00AB:0
CORRE171   C   007:00AC:0
CORRE172   C   007:00AE:4
CORRE173   C   007:00AE:4
CORRE174   C   007:00AE:4
CORRE175   C   007:00AE:4
CORRE176   C   007:00AE:4
CORRE177   C   007:00B0:0
CORRE178   C   007:00B1:2
CORRE179   C   007:00B8:4
CORRE180   C   007:00B8:4
CORRE181   C   007:00B8:4
CORRE182   C   007:00B8:4
CORRE183   C   007:00BC:2
CORRE184   C   007:00BD:0
CORRE185   C   007:00BE:3
CORRE186   C   007:00C5:0
CORRE187   C   007:00C6:0
CORRE188   C   007:00C7:0
CORRE189   C   007:00C9:5
CORRE190   C   007:00CC:1
CORRE191   C   007:00CF:1
CORRE192   C   007:00D1:5
CORREM01   C   007:00D4:3
CORREM02   C   007:00D8:3
CORREM03   C   007:00DA:3
CORREM04   C   007:00DB:0
CORREM05   C   007:00DC:3
CORRE194   C   007:00E4:5
CORRE195   C   007:00E4:5
CORRE196   C   007:00E4:5
CORRE197   C   007:00E4:5
CORRE198   C   007:00E6:4
CORRE199   C   007:00E8:0
CORRE200   C   007:00EC:5
CORRE201   C   007:00EC:5
CORRE202   C   007:00EC:5
CORRE203   C   007:00EC:5
CORRE204   C   007:00EC:5
CORRE205   C   007:00EE:0
CORRE206   C   007:00EF:0
CORRE207   C   007:00F0:5
CORRE208   C   007:00F6:2
CORRE209   C   007:00F6:5
        SEGMENT 007 IS 0100 LONG
```

```
C
C       SORT EIGENVALUES AND EIGENVECTORS
C
  165 IQ=-N
      DO 185 I=1,N
      IQ=IQ+N
      LL=I+(I*I-I)/2
      JQ=N*(I-2)
      DO 185 J=I,N
      JQ=JQ+N
      MM=J+(J*J-J)/2
      IF(A(LL)-A(MM)) 170,185,185
  170 X=A(LL)
      A(LL)=A(MM)
      A(MM)=X
      IF(NV-1) 175,185,175
  175 DO 180 K=1,N
      ILR=IQ+K
      IMR=JQ+K
      X=R(ILR)
      R(ILR)=R(IMR)
  180 R(IMR)=X
  185 CONTINUE
      RETURN
      END
```

```
EIGEN169   C   009:00A7:3
EIGEN170   C   009:00A7:3
EIGEN171   C   009:00A7:3
EIGEN172   C   009:00A7:3
EIGEN173   C   009:00A8:4
EIGEN174   C   009:00AA:0
EIGEN175   C   009:00AB:3
EIGEN176   C   009:00AE:1
EIGEN177   C   009:00B0:1
EIGEN178   C   009:00B1:0
EIGEN179   C   009:00B2:3
EIGEN180   C   009:00B5:1
EIGEN181   C   009:00B8:5
EIGEN182   C   009:00BA:5
EIGEN183   C   009:00BE:1
EIGEN184   C   009:00C0:2
EIGEN185   C   009:00C2:0
EIGEN186   C   009:00C3:0
EIGEN187   C   009:00C4:3
EIGEN188   C   009:00C6:0
EIGEN189   C   009:00C8:0
EIGEN190   C   009:00CB:2
EIGEN191   C   009:00CF:4
EIGEN192   C   009:00D4:0
EIGEN193   C   009:00D4:3
          SEGMENT 009 IS 00E1 LONG
```

```
C                                                                       TRACE001  C  009:00E110
C     ******************************************************************TRACE002  C  009:00E110
C                                                                       TRACE003  C  009:00E110
C        SUBROUTINE TRACE                                               TRACE004  C  009:00E110
C                                                                       TRACE005  C  009:00E110
C        PURPOSE                                                        TRACE006  C  009:00E110
C           COMPUTE CUMULATIVE PERCENTAGE OF EIGENVALUES GREATER THAN   TRACE007  C  009:00E110
C           OR EQUAL TO A CONSTANT SPECIFIED BY THE USER.  THIS SUB-    TRACE008  C  009:00E110
C           ROUTINE NORMALLY OCCURS IN A SEQUENCE OF CALLS TO SUB-      TRACE009  C  009:00E110
C           ROUTINES CORRE, EIGEN, TRACE, LOAD, AND VARMX IN THE PER-   TRACE010  C  009:00E110
C           FORMANCE OF A FACTOR ANALYSIS.                              TRACE011  C  009:00E110
C                                                                       TRACE012  C  009:00E110
C        USAGE                                                          TRACE013  C  009:00E110
C           CALL TRACE (M,R,CON,K,D)                                    TRACE014  C  009:00E110
C                                                                       TRACE015  C  009:00E110
C        DESCRIPTION OF PARAMETERS                                      TRACE016  C  009:00E110
C           M    - NUMBER OF VARIABLES.                                 TRACE017  C  009:00E110
C           R    - INPUT MATRIX (SYMMETRIC AND STORED IN COMPRESSED     TRACE018  C  009:00E110
C                  FORM WITH ONLY UPPER TRIANGLE BY COLUMN IN CORE)     TRACE019  C  009:00E110
C                  CONTAINING EIGENVALUES IN DIAGONAL.  EIGENVALUES ARE TRACE020  C  009:00E110
C                  ARRANGED IN DESCENDING ORDER.  THE ORDER OF MATRIX R TRACE021  C  009:00E110
C                  IS M BY M.  ONLY M*(M+1)/2 ELEMENTS ARE IN STORAGE.  TRACE022  C  009:00E110
C                  (STORAGE MODE OF 1)                                  TRACE023  C  009:00E110
C           CON  - A CONSTANT USED TO DECIDE HOW MANY EIGENVALUES TO    TRACE024  C  009:00E110
C                  RETAIN.  CUMULATIVE PERCENTAGE OF EIGENVALUES        TRACE025  C  009:00E110
C                  WHICH ARE GREATER THAN OR EQUAL TO THIS VALUE IS     TRACE026  C  009:00E110
C                  CALCULATED.                                          TRACE027  C  009:00E110
C           K    - OUTPUT VARIABLE CONTAINING THE NUMBER OF EIGENVALUES TRACE028  C  009:00E110
C                  GREATER THAN OR EQUAL TO CON.  (K IS THE NUMBER OF   TRACE029  C  009:00E110
C                  FACTORS.)                                            TRACE030  C  009:00E110
```

```
C              D      = OUTPUT VECTOR OF LENGTH M CONTAINING CUMULATIVE
C                       PERCENTAGE OF EIGENVALUES WHICH ARE GREATER THAN
C                       OR EQUAL TO CON.
C         REMARKS
C            NONE
C
C         SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
C            NONE
C
C         METHOD
C            EACH EIGENVALUE GREATER THAN OR EQUAL TO CON IS DIVIDED BY M
C            AND THE RESULT IS ADDED TO THE PREVIOUS TOTAL TO OBTAIN
C            THE CUMULATIVE PERCENTAGE FOR EACH EIGENVALUE.
C
C     ******************************************************************
C
      SUBROUTINE TRACE (M,R,CON,K,D)
      DIMENSION R(1),D(1)
C     ******************************************************************
C
C        IF A DOUBLE PRECISION VERSION OF THIS ROUTINE IS DESIRED, THE
C        C IN COLUMN 1 SHOULD BE REMOVED FROM THE DOUBLE PRECISION
C        STATEMENT WHICH FOLLOWS.
C
C     DOUBLE PRECISION R,D
C
C        THE C MUST ALSO BE REMOVED FROM DOUBLE PRECISION STATEMENTS
C        APPEARING IN OTHER ROUTINES USED IN CONJUNCTION WITH THIS
C        ROUTINE.
C
C     ******************************************************************
      FM=M
      L=0
      DO 100 I=1,M
      L=L+1
  100 D(I)=R(L)
      K=0
C
C     TEST WHETHER I-TH EIGENVALUE IS GREATER
C     THAN OR EQUAL TO THE CONSTANT
C
      DO 110 I=1,M
      IF(D(I)-CON) 120, 105, 105
  105 K=K+1
  110 D(I)=D(I)/FM
C
C     COMPUTE CUMULATIVE PERCENTAGE OF EIGENVALUES
C
  120 DO 130 I=2,K
  130 D(I)=D(I)+D(I-1)
      RETURN
      END
```

```
1RACE031  C   009:00E1:0
1RACE032  C   009:00E1:0
1RACE033  C   009:00E1:0
1RACE034  C   009:00E1:0
1RACE035  C   009:00E1:0
1RACE036  C   009:00E1:0
1RACE037  C   009:00E1:0
1RACE038  C   009:00E1:0
1RACE039  C   009:00E1:0
1RACE040  C   009:00E1:0
1RACE041  C   009:00E1:0
1RACE042  C   009:00E1:0
1RACE043  C   009:00E1:0
1RACE044  C   009:00E1:0
1RACE045  C   009:00E1:0
1RACE046  C   009:00E1:0
                    START OF SEGMENT 00A
1RACE047  C   00A:00001C
1RACE048  C   00A:000010
1RACE049  C   00A:000010
1RACE050  C   00A:000010
1RACE051  C   00A:000010
1RACE052  C   00A:000010
1RACE053  C   00A:000010
1RACE054  C   00A:000010
1RACE055  C   00A:000010
1RACE056  C   00A:000010
1RACE057  C   00A:000010
1RACE058  C   00A:000010
1RACE059  C   00A:000010
1RACE060  C   00A:000010
1RACE061  C   00A:000010
1RACE062  C   00A:000010
1RACE063  C   00A:000010
1RACE064  C   00A:000010
1RACE065  C   00A:000015
1RACE066  C   00A:000113
1RACE067  C   00A:000313
1RACE068  C   00A:000413
1RACE069  C   00A:000A10
1RACE070  C   00A:000A14
1RACE071  C   00A:000A14
1RACE072  C   00A:000A14
1RACE073  C   00A:000A14
1RACE074  C   00A:000A14
1RACE075  C   00A:000C10
1RACE076  C   00A:000E13
1RACE077  C   00A:000F15
1RACE078  C   00A:001414
1RACE079  C   00A:001414
1RACE080  C   00A:001414
1RACE081  C   00A:001414
1RACE082  C   00A:001610
1RACE083  C   00A:001C11
1RACE084  C   00A:001C14
                SEGMENT 00A IS 0025 LONG
```

```
C
C     ******************************************************************
C
C        SUBROUTINE LOAD
C
C        PURPOSE
C           COMPUTE A FACTOR MATRIX (LOADING) FROM EIGENVALUES AND
C           ASSOCIATED EIGENVECTORS.  THIS SUBROUTINE NORMALLY OCCURS
C           IN A SEQUENCE OF CALLS TO SUBROUTINES CORRE, EIGEN, TRACE,
C           LOAD, AND VARMX IN THE PERFORMANCE OF A FACTOR ANALYSIS.
C
C        USAGE
C           CALL LOAD (M,K,R,V)
C
C        DESCRIPTION OF PARAMETERS
C           M      - NUMBER OF VARIABLES.
C           K      - NUMBER OF FACTORS.
C           R      - A MATRIX (SYMMETRIC AND STORED IN COMPRESSED FORM
C                    WITH ONLY UPPER TRIANGLE BY COLUMN IN CORE) CON-
C                    TAINING EIGENVALUES IN DIAGONAL.  EIGENVALUES ARE
C                    ARRANGED IN DESCENDING ORDER, AND FIRST K EIGEN-
C                    VALUES ARE USED BY THIS SUBROUTINE.  THE ORDER OF
C                    MATRIX R IS M BY M.  ONLY M*(M+1)/2 ELEMENTS ARE IN
C                    STORAGE.  (STORAGE MODE OF 1)
C           V      - WHEN THIS SUBROUTINE IS CALLED, MATRIX V (M X M)
C                    CONTAINS EIGENVECTORS COLUMNWISE.  UPON RETURNING TO
C                    THE CALLING PROGRAM, MATRIX V CONTAINS A FACTOR
C                    MATRIX (M X K).
C
C        REMARKS
C           NONE
C
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
C           NONE
C
C        METHOD
C           NORMALIZED EIGENVECTORS ARE CONVERTED TO THE FACTOR PATTERN
C           BY MULTIPLYING THE ELEMENTS OF EACH VECTOR BY THE SQUARE
C           ROOT OF THE CORRESPONDING EIGENVALUE.
C
C     ******************************************************************
      SUBROUTINE LOAD (M,K,R,V)
      DIMENSION R(1),V(1)
C
C        ******************************************************************
C
C        IF A DOUBLE PRECISION VERSION OF THIS ROUTINE IS DESIRED, THE
C        C IN COLUMN 1 SHOULD BE REMOVED FROM THE DOUBLE PRECISION
C        STATEMENT WHICH FOLLOWS.
C
C     DOUBLE PRECISION R,V,SQ
C
C        THE C MUST ALSO BE REMOVED FROM DOUBLE PRECISION STATEMENTS
C        APPEARING IN OTHER ROUTINES USED IN CONJUNCTION WITH THIS
C        ROUTINE.
C
C        THE DOUBLE PRECISION VERSION OF THIS SUBROUTINE MUST ALSO
C        CONTAIN DOUBLE PRECISION FORTRAN FUNCTIONS.  SQRT IN STATEMENT
C        150 MUST BE CHANGED TO DSQRT.
C
C        ******************************************************************
      L=0
      JJ=0
      DO 160 J=1,K
      JJ=JJ+J
  150 SQ=SQRT(R(JJ))
      DO 160 I=1,M
      L=L+1
  160 V(L)=SQ*V(L)
      RETURN
      END
```

```
LOAD 001   C   00A:002510
LOAD 002   C   00A:002510
LOAD 003   C   00A:002510
LOAD 004   C   00A:002510
LOAD 005   C   00A:002510
LOAD 006   C   00A:002510
LOAD 007   C   00A:002510
LOAD 008   C   00A:002510
LOAD 009   C   00A:002510
LOAD 010   C   00A:002510
LOAD 011   C   00A:002510
LOAD 012   C   00A:002510
LOAD 013   C   00A:002510
LOAD 014   C   00A:002510
LOAD 015   C   00A:002510
LOAD 016   C   00A:002510
LOAD 017   C   00A:002510
LOAD 018   C   00A:002510
LOAD 019   C   00A:002510
LOAD 020   C   00A:002510
LOAD 021   C   00A:002510
LOAD 022   C   00A:002510
LOAD 023   C   00A:002510
LOAD 024   C   00A:002510
LOAD 025   C   00A:002510
LOAD 026   C   00A:002510
LOAD 027   C   00A:002510
LOAD 028   C   00A:002510
LOAD 029   C   00A:002510
LOAD 030   C   00A:002510
LOAD 031   C   00A:002510
LOAD 032   C   00A:002510
LOAD 033   C   00A:002510
LOAD 034   C   00A:002510
LOAD 035   C   00A:002510
LOAD 036   C   00A:002510
LOAD 037   C   00A:002510
LOAD 038   C   00A:002510
LOAD 039   C   00A:002510
LOAD 040   C   00A:002510
LOAD 041   C   00A:002510
LOAD 042   C   00A:002510
                    START OF SEGMENT 00B
LOAD 043   C   00B:000000
LOAD 044   C   00B:000000
LOAD 045   C   00B:000000
LOAD 046   C   00B:000000
LOAD 047   C   00B:000000
LOAD 048   C   00B:000000
LOAD 049   C   00B:000000
LOAD 050   C   00B:000000
LOAD 051   C   00B:000000
LOAD 052   C   00B:000000
LOAD 053   C   00B:000000
LOAD 054   C   00B:000000
LOAD 055   C   00B:000010
LOAD 056   C   00B:000010
LOAD 057   C   00B:000010
LOAD 058   C   00B:000010
LOAD 059   C   00B:000010
LOAD 060   C   00B:000010
LOAD 061   C   00B:000010
LOAD 062   C   00B:000010
LOAD 063   C   00B:000010
LOAD 064   C   00B:000010
LOAD 065   C   00B:000014
LOAD 066   C   00B:000112
LOAD 067   C   00B:000210
LOAD 068   C   00B:000313
LOAD 069   C   00B:000611
LOAD 070   C   00B:000710
LOAD 071   C   00B:000812
LOAD 072   C   00B:001013
LOAD 073   C   00B:001110
                    SEGMENT 00B IS 0018 LONG
```

```
C     ******************************************************************
C        SUBROUTINE VARMX
C
C        PURPOSE
C           PERFORM ORTHOGONAL ROTATIONS OF A FACTOR MATRIX.  THIS
C           SUBROUTINE NORMALLY OCCURS IN A SEQUENCE OF CALLS TO SUB-
C           ROUTINES CORRE, EIGEN, TRACE, LOAD, VARMX IN THE PERFORMANCE
C           OF A FACTOR ANALYSIS.
C
C        USAGE
C           CALL VARMX (M,K,A,NC,TV,H,F,D)
C
C        DESCRIPTION OF PARAMETERS
C           M      - NUMBER OF VARIABLES AND NUMBER OF ROWS OF MATRIX A.
C           K      - NUMBER OF FACTORS.
C           A      - INPUT IS THE ORIGINAL FACTOR MATRIX, AND OUTPUT IS
C                    THE ROTATED FACTOR MATRIX.  THE ORDER OF MATRIX A
C                    IS M X K.
C           NC     - OUTPUT VARIABLE CONTAINING THE NUMBER OF ITERATION
C                    CYCLES PERFORMED.
C           TV     - OUTPUT VECTOR CONTAINING THE VARIANCE OF THE FACTOR
C                    MATRIX FOR EACH ITERATION CYCLE.  THE VARIANCE PRIOR
C                    TO THE FIRST ITERATION CYCLE IS ALSO CALCULATED.
C                    THIS MEANS THAT NC+1 VARIANCES ARE STORED IN VECTOR
C                    TV.  MAXIMUM NUMBER OF ITERATION CYCLES ALLOWED IN
C                    THIS SUBROUTINE IS 50.  THEREFORE, THE LENGTH OF
C                    VECTOR TV IS 51.
C           H      - OUTPUT VECTOR OF LENGTH M CONTAINING THE ORIGINAL
C                    COMMUNALITIES.
C           F      - OUTPUT VECTOR OF LENGTH M CONTAINING THE FINAL
C                    COMMUNALITIES.
C           D      - OUTPUT VECTOR OF LENGTH M CONTAINING THE DIFFERENCES
C                    BETWEEN THE ORIGINAL AND FINAL COMMUNALITIES.
C
C        REMARKS
C           IF VARIANCE COMPUTED AFTER EACH ITERATION CYCLE DOES NOT
C           INCREASE FOR FOUR SUCCESSIVE TIMES, THE SUBROUTINE STOPS
C           ROTATION.
C
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
C           NONE
C
C        METHOD
C           KAISER'S VARIMAX ROTATION AS DESCRIBED IN 'COMPUTER PROGRAM
C           FOR VARIMAX ROTATION IN FACTOR ANALYSIS' BY THE SAME AUTHOR,
C           EDUCATIONAL AND PSYCHOLOGICAL MEASUREMENT, VOL XIX, NO. 3,
C           1959.
C     ******************************************************************
C
      SUBROUTINE VARMX (M,K,A,NC,TV,H,F,D)
      DIMENSION A(1),TV(1),H(1),F(1),D(1)
C     ******************************************************************
C        IF A DOUBLE PRECISION VERSION OF THIS ROUTINE IS DESIRED, THE
C        C IN COLUMN 1 SHOULD BE REMOVED FROM THE DOUBLE PRECISION
C        STATEMENT WHICH FOLLOWS.
C
C     DOUBLE PRECISION A,TV,H,F,D,TVLT,CONS,AA,BB,CC,DD,U,T,B,COS4T,
C    1                 SIN4T,TAN4T,SINP,COSP,CTN4T,COS2T,SIN2T,CCST,SINT
C
C        THE C MUST ALSO BE REMOVED FROM DOUBLE PRECISION STATEMENTS
C        APPEARING IN OTHER ROUTINES USED IN CONJUNCTION WITH THIS
C        ROUTINE.
C
C        THE DOUBLE PRECISION VERSION OF THIS SUBROUTINE MUST ALSO
C        CONTAIN DOUBLE PRECISION FORTRAN FUNCTIONS.  SQRT IN STATEMENTS
C        115, 290, 330, 350, AND 355 MUST BE CHANGED TO DSQRT.  ABS IN
C        STATEMENTS 280, 320, AND 375 MUST BE CHANGED TO DABS.
C     ******************************************************************
C     INITIALIZATION
C
      EPS=0.00116
      TVLT=0.0
      LL=K-1
      NV=1
      NC=0
      FM=M
      FFN=FN*FN
      CONS=0.7071066
C
```

```
VARMX001  C   OOB:CC1810
VARMX002  C   OOB:CC1810
VARMX003  C   OOB:CC1810
VARMX004  C   OOB:CC1810
VARMX005  C   OOB:CC1810
VARMX006  C   OOB:CC1810
VARMX007  C   OOB:CC1810
VARMX008  C   OOB:CC1810
VARMX009  C   OOB:CC1810
VARMX010  C   OOB:CC1810
VARMX011  C   OOB:CC1810
VARMX012  C   OOB:CC1810
VARMX013  C   OOB:CC1810
VARMX014  C   OOB:CC1810
VARMX015  C   OOB:CC1810
VARMX016  C   OOB:CC1810
VARMX017  C   OOB:CC1810
VARMX018  C   OOB:CC1810
VARMX019  C   OOB:CC1810
VARMX020  C   OOB:CC1810
VARMX021  C   OOB:CC1810
VARMX022  C   OOB:CC1810
VARMX023  C   OOB:CC1810
VARMX024  C   OOB:CC1810
VARMX025  C   OOB:CC1810
VARMX026  C   OOB:CC1810
VARMX027  C   OOB:CC1810
VARMX028  C   OOB:CC1810
VARMX029  C   OOB:CC1810
VARMX030  C   OOB:CC1810
VARMX031  C   OOB:CC1810
VARMX032  C   OOB:CC1810
VARMX033  C   OOB:CC1810
VARMX034  C   OOB:CC1810
VARMX035  C   OOB:CC1810
VARMX036  C   OOB:CC1810
VARMX037  C   OOB:CC1810
VARMX038  C   OOB:CC1810
VARMX039  C   OOB:CC1810
VARMX040  C   OOB:CC1810
VARMX041  C   OOB:CC1810
VARMX042  C   OOB:CC1810
VARMX043  C   OOB:CC1810
VARMX044  C   OOB:CC1810
VARMX045  C   OOB:CC1810
VARMX046  C   OOB:CC1810
VARMX047  C   OOB:CC1810
VARMX048  C   OOB:CC1810
VARMX049  C   OOB:CC1810
VARMX050  C   OOB:CC1810
VARMX051  C   OOB:CC1810
VARMX052  C   OOB:CC1810
                  START OF SEGMENT OOC
VARMX053  C   OOC:000010
VARMX054  C   OOC:000010
VARMX055  C   OOC:000010
VARMX056  C   OOC:000010
VARMX057  C   OOC:000010
VARMX058  C   OOC:000010
VARMX059  C   OOC:000010
VARMX060  C   OOC:000010
VARMX061  C   OOC:000010
VARMX062  C   OOC:000010
VARMX063  C   OOC:000010
VARMX064  C   OOC:000010
VARMX065  C   OOC:000010
VARMX066  C   OOC:000010
VARMX067  C   OOC:000010
VARMX068  C   OOC:000010
VARMX069  C   OOC:000010
VARMX070  C   OOC:000010
VARMX071  C   OOC:000010
VARMX072  C   OOC:000010
VARMX073  C   OOC:000010
VARMX074  C   OOC:000010
VARMX075  C   OOC:000010
VARMX076  C   OOC:000010
VARMX077  C   OOC:000010
VARMX078  C   OOC:000213
VARMX079  C   OOC:000311
VARMX080  C   OOC:000413
VARMX081  C   OOC:000511
VARMX082  C   OOC:000515
VARMX083  C   OOC:000614
VARMX084  C   OOC:000713
VARMX085  C   OOC:000913
```

```
C     CALCULATE ORIGINAL COMMUNALITIES
C
      DO 110 I=1,M
      H(I)=0.0
      DO 110 J=1,K
      L=M*(J-1)+I
  110 H(I)=H(I)+A(L)*A(L)
C
C     CALCULATE NORMALIZED FACTOR MATRIX
C
      DO 120 I=1,M
  115 H(I)= SQRT(H(I))
      DO 120 J=1,K
      L=M*(J-1)+I
  120 A(L)=A(L)/H(I)
      GO TO 132
C
C     CALCULATE VARIANCE FOR FACTOR MATRIX
C
  130 NV=NV+1
      TVLT=TV(NV-1)
  132 TV(NV)=0.0
      DO 150 J=1,K
      AA=0.0
      BB=0.0
      LB=M*(J-1)
      DO 140 I=1,M
      L=LB+I
      CC=A(L)*A(L)
      AA=AA+CC
  140 BB=BB+CC*CC
  150 TV(NV)=TV(NV)+(FN*BB-AA*AA)/FFN
      IF(NV-51) 160, 430, 430
C
C     PERFORM CONVERGENCE TEST
C
  160 IF((TV(NV)-TVLT)-(1.E-7)) 170, 170, 190
  170 NC=NC+1
      IF(NC-3) 190, 190, 430
C
C     ROTATION OF TWO FACTORS CONTINUES UP TO
C     THE STATEMENT 120.
C
  190 DO 420 J=1,LL
      L1=M*(J-1)
      II=J+1
C
C        CALCULATE NUM AND DEN
C
      DO 420 K1=II,K
      L2=M*(K1-1)
      AA=0.0
      BB=0.0
      CC=0.0
      DD=0.0
      DO 230 I=1,M
      L3=L1+I
      L4=L2+I
      U=(A(L3)+A(L4))*(A(L3)-A(L4))
      T=A(L3)*A(L4)
      T=T+T
      CC=CC+(U+T)*(U-T)
      DD=DD+2.0*U*T
      AA=AA+U
  230 BB=BB+T
      T=DD-2.0*AA*BB/FN
      B=CC-(AA*AA-BB*BB)/FN
C
C        COMPARISON OF NUM AND DEN
C
      IF(T-B) 280, 240, 320
  240 IF((T+B)-EPS) 420, 250, 250
C
C        NUM + DEN IS GREATER THAN OR EQUAL TO THE
C        TOLERANCE FACTOR
C
  250 COS4T=CONS
      SIN4T=CONS
      GO TO 350
C
C        NUM IS LESS THAN DEN
C
  280 TAN4T= ABS(T)/ ABS(B)
      IF(TAN4T-EPS) 300, 290, 290
  290 COS4T=1.0/ SQRT(1.0+TAN4T*TAN4T)
      SIN4T=TAN4T*COS4T
      GO TO 350
```

```
VARMX086  C  00C1C0C9I3
VARMX087  C  00C1C0C9I3
VARMX088  C  00C1C0C9I3
VARMX089  C  00C1C0CBI0
VARMX090  C  00C1C0CDI0
VARMX091  C  00C1C0CEI0
VARMX092  C  00C1C010I2
VARMX093  C  00C1C01AI1
VARMX094  C  00C1C01AI1
VARMX095  C  00C1C01AI1
VARMX096  C  00C1C01AI1
VARMX097  C  00C1C01BI0
VARMX098  C  00C1C01DI5
VARMX099  C  00C1C01FI0
VARMX100  C  00C1C021I2
VARMX101  C  00C1C024I3
VARMX102  C  00C1C02AI0
VARMX103  C  00C1C02AI0
VARMX104  C  00C1C02AI0
VARMX105  C  00C1C02AI0
VARMX106  C  00C1C02BI2
VARMX107  C  00C1C02DI1
VARMX108  C  00C1C02FI1
VARMX109  C  00C1C030I0
VARMX110  C  00C1C030I4
VARMX111  C  00C1C031I2
VARMX112  C  00C1C033I1
VARMX113  C  00C1C034I0
VARMX114  C  00C1C035I3
VARMX115  C  00C1C038I5
VARMX116  C  00C1C03AI1
VARMX117  C  00C1C03EI0
VARMX118  C  00C1C044I4
VARMX119  C  00C1C046I3
VARMX120  C  00C1C046I3
VARMX121  C  00C1C046I3
VARMX122  C  00C1C046I3
VARMX123  C  00C1C04AI4
VARMX124  C  00C1C04CI0
VARMX125  C  00C1C04DI3
VARMX126  C  00C1C04DI3
VARMX127  C  00C1C04DI3
VARMX128  C  00C1C04DI3
VARMX129  C  00C1C04DI3
VARMX130  C  00C1C04FI0
VARMX131  C  00C1C050I5
VARMX132  C  00C1C052I1
VARMX133  C  00C1C052I1
VARMX134  C  00C1C052I1
VARMX135  C  00C1C052I1
VARMX136  C  00C1C053I0
VARMX137  C  00C1C054I5
VARMX138  C  00C1C055I3
VARMX139  C  00C1C056I1
VARMX140  C  00C1C056I5
VARMX141  C  00C1C057I3
VARMX142  C  00C1C059I0
VARMX143  C  00C1C05AI3
VARMX144  C  00C1C05CI0
VARMX145  C  00C1C063I0
VARMX146  C  00C1C066I4
VARMX147  C  00C1C067I3
VARMX148  C  00C1C06AI2
VARMX149  C  00C1C06CI4
VARMX150  C  00C1C06EI0
VARMX151  C  00C1C071I3
VARMX152  C  00C1C074I2
VARMX153  C  00C1C077I2
VARMX154  C  00C1C077I2
VARMX155  C  00C1C077I2
VARMX156  C  00C1C077I2
VARMX157  C  00C1C07AI4
VARMX158  C  00C1C07DI0
VARMX159  C  00C1C07DI0
VARMX160  C  00C1C07DI0
VARMX161  C  00C1C07DI0
VARMX162  C  00C1C07DI0
VARMX163  C  00C1C07DI5
VARMX164  C  00C1C07EI4
VARMX165  C  00C1C07FI1
VARMX166  C  00C1C07FI1
VARMX167  C  00C1C07FI1
VARMX168  C  00C1C07FI1
VARMX169  C  00C1C081I1
VARMX170  C  00C1C082I1
VARMX171  C  00C1C084I4
```

```
      360 IF(B) 310, 420, 420
      310 SINP=CONS
          COSP=CONS
          GO TO 400
C
CC        NUM IS GREATER THAN DEN
C
      320 CTN4T= ABS(T/B)
          IF(CTN4T-EPS) 340, 330, 330
      330 SIN4T=1.0/ SQRT(1.0+CTN4T*CTN4T)
          COS4T=CTN4T*SIN4T
          GO TO 350
      340 COS4T=0.0
          SIN4T=1.0
C
CC        DETERMINE COS THETA AND SIN THETA
C
      350 COS2T= SQRT((1.0+COS4T)/2.0)
          SIN2T=SIN4T/(2.0*COS2T)
      355 COST= SQRT((1.0+COS2T)/2.0)
          SINT=SIN2T/(2.0*COST)
C
CC        DETERMINE COS PHI AND SIN PHI
C
          IF(B) 370, 370, 360
      360 COSP=COST
          SINP=SINT
          GO TO 380
      370 COSP=CONS*COST+CONS*SINT
      375 SINP= ABS(CONS*COST-CONS*SINT)
      380 IF(T) 390, 390, 400
      390 SINP=-SINP
C
CC        PERFORM ROTATION
C
      400 DO 410 I=1,M
          L3=L1+I
          L4=L2+I
          AA=A(L3)*COSP+A(L4)*SINP
          A(L4)=-A(L3)*SINP+A(L4)*COSP
      410 A(L3)=AA
      420 CONTINUE
          GO TO 130
C
CC    DENORMALIZE VARIMAX LOADINGS
C
      430 DO 440 I=1,M
          DO 440 J=1,K
          L=M*(J-1)+I
      440 A(L)=A(L)*H(I)
C
CC    CHECK ON COMMUNALITIES
C
          NC=NV-1
          DO 450 I=1,M
      450 H(I)=H(I)*H(I)
          DO 470 I=1,M
          F(I)=0.0
          DO 460 J=1,K
          L=M*(J-1)+I
      460 F(I)=F(I)+A(L)*A(L)
      470 D(I)=H(I)-F(I)
          RETURN
          END
```

```
VARMX173  C  000:0086:3
VARMX174  C  000:0087:4
VARMX175  C  000:0088:3
VARMX176  C  000:0089:2
VARMX177  C  000:008A:5
VARMX178  C  000:008B:5
VARMX179  C  000:008B:5
VARMX180  C  000:008B:5
VARMX181  C  000:008B:3
VARMX182  C  000:008C:3
VARMX183  C  000:003F:0
VARMX184  C  000:0090:2
VARMX185  C  000:0090:5
VARMX186  C  000:0091:3
VARMX187  C  000:0092:1
VARMX188  C  000:0092:1
VARMX189  C  000:0092:1
VARMX190  C  000:0092:1
VARMX191  C  000:0094:3
VARMX192  C  000:0096:2
VARMX193  C  000:0098:4
VARMX194  C  000:009A:3
VARMX195  C  000:009A:3
VARMX196  C  000:009A:3
VARMX197  C  000:009A:3
VARMX198  C  000:009B:4
VARMX199  C  000:009C:3
VARMX200  C  000:009D:2
VARMX201  C  000:009D:5
VARMX202  C  000:00A0:1
VARMX203  C  000:00A2:5
VARMX204  C  000:00A4:0
VARMX205  C  000:00A5:0
VARMX206  C  000:00A5:0
VARMX207  C  000:00A5:0
VARMX208  C  000:00A5:0
VARMX209  C  000:00A6:0
VARMX210  C  000:00A7:3
VARMX211  C  000:00A9:0
VARMX212  C  000:00AD:4
VARMX213  C  000:00B2:4
VARMX214  C  000:00B7:0
VARMX215  C  000:00B8:2
VARMX216  C  000:00BB:5
VARMX217  C  000:00BB:5
VARMX218  C  000:00BB:5
VARMX219  C  000:00BB:5
VARMX220  C  000:00BD:0
VARMX221  C  000:00BE:0
VARMX222  C  000:00C0:2
VARMX223  C  000:00C8:3
VARMX224  C  000:00C8:3
VARMX225  C  000:00C8:3
VARMX226  C  000:00C8:3
VARMX227  C  000:00C9:5
VARMX228  C  000:00CB:0
VARMX229  C  000:00CF:4
VARMX230  C  000:00D1:0
VARMX231  C  000:00D3:0
VARMX232  C  000:00D4:0
VARMX233  C  000:00D6:2
VARMX234  C  000:00DE:0
VARMX235  C  000:00E5:1
VARMX236  C  000:00E5:4
        SEGMENT 00C IS 00F3 LONG
```

FACTOR ANALYSIS.....RUN 3

NO. OF CASES 123
NO. OF VARIABLES 20

4.7	7.0	7.0	5.7	6.3	4.0	7.0	222.9	6.5	6.7	6.5	4.6	4.7	6.3	3.9	2.0
6.0	6.3	6.0	6.5												
5.3	4.3	5.0	6.0	2.3	3.3	5.0	68.3	5.3	5.7	3.8	5.0	5.5	5.0	3.5	3.0
6.0	6.0	4.0	4.5												
6.7	6.0	6.3	4.7	6.7	5.3	7.0	196.5	6.0	6.5	6.5	4.6	5.8	7.0	4.4	4.0
6.0	5.3	4.3	5.5												
7.0	6.3	6.3	5.7	6.3	4.7	6.3	234.8	6.3	6.2	5.8	4.6	6.2	7.0	4.3	3.0
5.5	6.0	4.7	6.0												
6.3	2.7	6.3	6.0	6.0	5.0	6.3	183.8	6.3	6.2	5.5	5.4	5.0	5.3	3.5	4.0
6.9	6.0	6.0	6.0												
4.7	4.0	4.0	5.0	3.7	4.7	4.0	77.2	5.3	5.8	4.0	6.0	5.5	6.5	3.1	3.5
6.0	6.3	6.7	6.3												
5.0	4.0	4.7	5.0	4.3	3.7	4.7	98.6	5.5	5.2	3.5	5.2	4.7	5.5	3.3	2.5
5.5	6.0	5.7	6.0												
6.0	4.3	6.3	5.7	6.3	2.7	6.0	199.0	6.3	5.5	5.0	5.4	5.7	4.2	3.7	5.0
5.5	5.7	5.3	5.5												
5.0	4.7	5.7	6.3	6.7	3.3	6.7	215.3	5.8	6.7	5.8	6.4	5.5	7.0	3.9	6.0
6.5	6.3	5.3	7.0												
4.7	6.0	6.3	3.0	5.3	1.0	6.7	90.6	4.3	4.5	5.3	2.6	6.5	5.5	3.6	5.0
5.0	6.0	2.0	5.0												
2.0	3.3	6.7	4.0	3.7	5.3	4.3	58.5	5.5	7.0	5.5	4.4	6.5	3.5	3.1	7.0
6.5	6.0	6.0	6.3												
3.7	4.7	5.3	4.0	6.0	5.0	5.0	109.2	6.0	5.7	5.0	4.6	5.2	4.0	3.6	5.5
7.0	5.7	6.3	6.3												
1.7	3.3	2.7	4.7	4.3	3.3	5.3	51.5	4.8	4.7	4.3	3.6	4.7	4.0	3.0	3.5
4.5	4.3	3.7	4.5												
3.3	4.0	6.7	6.3	5.7	3.7	6.3	167.1	5.0	6.5	5.8	3.6	6.0	5.0	3.4	4.0
5.0	5.7	5.3	5.5												
7.0	5.3	6.0	6.0	4.7	2.7	5.0	170.8	5.5	5.5	5.3	4.4	6.3	7.0	3.7	2.0
4.5	6.0	4.3	5.0												
7.0	4.7	7.0	7.0	6.3	3.0	7.0	275.6	6.3	6.3	6.0	5.6	5.2	5.5	3.3	6.0
6.0	6.3	6.7	6.3												
4.7	2.7	6.7	5.3	5.0	3.3	6.3	124.2	6.0	5.5	5.3	5.0	6.0	5.3	3.3	3.0
6.0	6.0	4.3	5.5												
6.3	5.3	6.3	5.7	6.3	2.3	6.3	214.9	4.5	5.7	3.8	3.2	5.2	6.2	4.1	2.0
6.0	5.3	6.0	3.8												
3.3	6.0	7.0	4.3	5.7	4.0	5.7	133.4	5.8	5.5	5.3	5.0	5.8	4.0	2.8	4.5
6.0	5.7	6.0	6.0												
6.7	5.7	7.0	5.7	6.7	6.3	6.3	242.6	5.3	4.3	5.3	3.4	5.5	6.3	3.7	1.0
5.0	6.0	6.0	6.0												
6.7	7.0	6.7	4.3	4.3	3.3	7.0	127.0	5.5	5.0	6.0	4.2	6.5	6.5	4.4	4.0
3.5	4.7	1.3	2.0												
4.3	3.7	7.0	4.3	5.7	4.3	4.0	122.5	6.0	5.8	5.0	5.2	6.0	6.7	3.6	2.5
4.5	4.7	6.0	3.5												
4.7	2.3	4.7	5.0	4.0	3.3	7.0	77.7	6.5	6.5	6.0	6.2	5.0	5.7	2.8	3.5
6.0	5.7	5.3	5.3												
2.7	3.0	7.0	5.3	6.0	4.7	6.7	135.0	4.5	5.0	5.0	5.2	5.3	4.7	2.8	3.5
6.5	5.7	6.0	6.0												
3.3	5.0	5.0	4.0	3.0	2.0	5.0	53.3	0.0	0.0	0.0	0.0	0.0	5.0	3.6	5.0
6.0	6.0	5.0	5.3												
3.7	3.7	5.0	5.0	3.7	4.0	7.0	75.2	0.0	0.0	0.0	0.0	0.0	6.0	2.5	5.0
6.0	6.7	6.3	6.3												
5.7	3.7	6.3	5.7	5.7	3.3	5.3	167.1	6.8	6.7	4.0	4.6	6.7	4.0	3.4	2.5
4.5	6.0	6.0	5.0												
5.3	2.3	6.0	4.3	4.7	6.3	6.7	91.9	6.8	4.5	5.3	5.6	6.7	7.0	3.9	6.0
6.5	7.0	7.0	5.8												
4.7	4.7	6.0	5.3	5.7	4.3	5.0	154.1	5.3	6.5	5.5	5.8	4.5	4.7	2.8	6.0
6.5	6.7	7.0	6.5												
4.0	3.0	4.0	4.0	3.3	3.3	6.7	48.8	5.0	4.8	3.5	5.2	5.3	5.2	3.3	6.0
6.0	6.0	5.3	5.8												
5.3	5.3	5.3	5.7	7.0	6.7	6.0	211.2	6.8	6.5	6.8	6.4	4.7	5.8	2.8	3.0
5.5	6.0	6.3	6.0												
6.7	4.0	4.7	5.0	6.0	5.3	6.7	153.2	6.3	5.8	6.0	5.2	5.7	3.8	3.0	6.0
6.0	5.7	6.0	6.0												
5.3	5.0	4.3	5.0	4.7	4.0	5.7	113.9	4.3	5.7	4.0	3.6	4.7	5.7	3.9	5.5
5.0	6.0	5.3	4.5												
2.3	4.3	4.0	5.0	3.7	3.0	5.3	65.0	4.5	3.2	4.0	4.6	3.0	2.0	3.0	4.0
4.0	6.0	5.3	6.3												
6.0	5.0	6.7	6.3	4.3	7.0	7.0	161.4	6.0	7.0	5.3	6.0	5.2	5.5	3.0	7.0
6.5	6.7	7.0	6.0												
3.7	5.7	6.3	6.0	5.0	2.7	6.7	156.5	6.5	6.3	6.0	5.6	6.3	4.5	3.3	6.0
6.0	6.0	6.0	4.3												
5.7	3.3	5.0	6.0	6.0	3.3	6.3	167.9	5.3	5.7	5.0	4.6	5.7	5.5	3.8	4.0
6.0	5.6	5.0	5.3												
5.7	6.3	7.0	6.3	5.0	4.0	5.3	200.3	5.3	5.3	4.3	4.6	4.8	6.7	2.8	5.0
6.5	5.7	5.3	6.0												
6.3	6.7	7.0	5.3	5.3	5.0	6.7	189.3	6.3	6.2	6.0	6.2	5.8	3.4	2.2	4.0
6.0	6.0	6.0	5.3												
4.3	1.7	6.7	5.7	6.7	5.3	7.0	159.0	6.3	6.8	4.3	4.6	6.5	7.0	3.3	5.0
5.5	5.3	5.7	6.3												
3.3	3.7	3.7	5.7	6.0	4.0	7.0	120.6	6.3	5.3	5.5	6.4	6.0	5.0	2.9	7.0
6.0	6.3	6.7	5.8												

6.3	5.3	7.0	3.7	3.7	4.0	7.0	83.3	5.3	5.0	4.5	5.4	3.8	6.3	3.5	5.0
5.5	6.7	6.0	6.0												
5.0	2.3	5.7	6.0	5.7	3.0	5.0	147.1	5.3	6.2	5.0	5.4	5.2	4.7	3.7	5.5
6.0	6.0	6.0	0.0												
6.3	4.3	6.0	5.3	5.3	5.7	6.3	157.8	6.0	6.2	6.0	6.0	6.2	6.0	3.7	6.0
6.5	6.0	6.3	5.8												
6.7	4.0	6.7	6.7	6.0	4.3	7.0	230.7	5.8	6.3	6.0	5.2	5.0	5.2	3.3	3.0
6.0	5.3	6.0	5.3												
6.3	3.7	7.0	6.3	6.0	4.7	7.0	215.1	6.3	5.8	5.3	5.0	5.3	6.2	3.3	5.0
6.0	6.0	6.0	6.0												
5.0	4.0	4.3	3.7	4.3	4.0	5.0	70.4	6.5	6.3	5.0	5.0	5.5	6.5	2.3	5.0
6.5	6.3	6.3	6.0												
5.7	4.3	3.3	5.7	2.7	3.0	5.0	66.9	6.0	5.3	4.5	6.2	4.5	5.0	2.8	5.5
6.0	6.3	6.0	6.0												
3.0	4.3	3.3	4.7	3.7	4.0	4.0	60.6	3.0	3.3	3.0	3.0	3.3	3.5	3.3	1.5
6.5	4.7	3.7	4.3												
4.3	3.8	5.0	5.7	4.0	2.7	6.3	99.3	6.0	6.2	6.0	5.5	4.7	5.5	3.3	3.0
3.0	6.0	6.0	5.0												
6.7	3.0	7.0	5.0	4.0	2.3	7.0	111.1	6.0	6.2	3.0	4.0	5.7	5.5	3.2	3.0
6.0	5.0	2.7	5.5												
6.3	6.7	5.7	6.7	6.0	4.0	6.3	248.4	5.5	6.5	6.0	5.0	5.7	6.7	3.9	5.5
6.0	6.3	6.3	5.0												
0.0	6.0	6.7	6.3	6.0	4.7	6.7	236.2	6.3	6.0	5.3	6.2	4.3	5.5	3.8	3.5
6.5	5.7	5.0	5.3												
2.7	3.3	5.3	6.3	5.3	6.0	7.0	127.3	6.5	6.3	6.5	5.0	6.0	6.5	3.4	6.0
0.0	5.7	6.7	6.0												
4.7	4.7	5.0	6.0	5.7	5.7	5.3	162.1	5.8	6.0	6.0	6.0	5.0	5.7	3.3	6.0
4.0	6.0	6.0	6.3												
6.7	3.3	6.7	6.7	5.7	6.3	5.7	209.2	6.3	6.0	5.3	5.0	5.8	5.6	3.2	6.0
6.0	5.3	6.0	6.5												
6.0	6.7	7.0	6.7	6.3	5.7	6.0	276.3	6.0	6.0	6.3	6.2	4.7	7.0	4.0	6.0
6.5	6.0	6.7	6.5												
6.7	6.5	5.0	6.0	6.0	5.3	5.0	215.9	5.5	6.0	5.5	6.0	6.0	6.0	3.6	3.0
6.0	6.0	5.7	6.0												
5.7	1.7	6.0	4.0	5.0	1.0	6.7	88.8	5.3	5.7	4.8	5.0	5.7	6.2	3.9	3.0
7.0	4.3	5.7	5.3												
6.3	6.7	7.0	6.0	5.7	5.0	6.7	226.3	6.3	6.3	6.0	6.4	4.8	6.2	3.4	4.0
4.0	5.7	6.0	6.3												
5.7	4.7	0.0	6.0	4.7	5.7	6.7	152.1	3.3	5.7	4.8	3.2	5.5	4.3	3.4	5.0
3.0	4.7	4.7	4.8												
4.0	7.0	5.7	6.3	5.3	5.0	6.3	187.4	6.5	5.8	6.0	6.5	4.2	3.7	2.9	6.0
6.0	6.0	6.3	6.0												
5.3	3.7	5.3	4.7	5.7	5.7	5.7	125.9	6.3	6.0	6.0	6.0	5.5	4.3	3.1	2.0
4.5	6.0	0.0	6.0												
7.0	7.0	6.7	6.7	7.0	5.7	6.7	321.1	6.3	6.3	6.5	6.4	6.3	5.2	3.1	6.0
4.5	6.0	6.7	6.5												
4.7	4.0	5.3	5.0	5.3	4.0	4.7	124.3	6.0	5.8	5.5	4.6	5.5	4.0	3.9	6.0
0.0	4.7	3.3	4.5												
1.7	3.7	4.0	5.0	5.3	3.3	4.0	82.8	4.3	6.2	6.0	5.4	5.5	5.0	3.3	6.0
5.0	6.3	6.0	4.5												
4.3	4.7	4.7	5.7	4.0	3.7	4.7	100.5	5.5	4.7	5.3	6.2	4.5	4.5	2.8	6.0
6.0	5.7	5.7	5.5												
0.0	5.7	5.3	5.7	6.7	4.0	6.7	213.5	6.8	6.8	6.8	6.0	6.5	5.5	3.3	3.0
6.5	6.0	6.0	6.8												
6.3	4.7	6.7	6.7	6.3	5.7	6.3	246.0	6.3	6.3	6.0	5.2	6.0	4.0	3.3	5.0
6.0	5.3	6.0	6.0												
6.3	5.3	5.7	6.3	3.7	3.3	6.0	138.8	5.5	5.2	5.0	4.0	5.8	4.5	3.0	2.0
0.0	5.7	0.0	6.0												
2.7	5.7	3.3	6.0	6.7	6.0	5.3	181.8	5.0	6.2	5.8	5.0	5.7	6.2	2.6	6.0
6.5	6.0	6.0	6.0												
6.3	6.7	5.3	6.0	5.3	3.7	5.7	195.3	6.0	5.8	6.0	4.6	5.5	7.0	3.1	3.0
5.0	6.0	5.0	3.8												
6.7	6.3	2.7	4.3	3.7	3.3	4.7	82.7	3.8	4.0	4.5	3.4	6.0	6.0	3.3	3.0
5.0	3.6	4.0	5.0												
5.0	4.7	5.0	5.7	6.3	6.3	7.0	175.1	5.8	5.5	5.5	4.2	5.8	4.7	3.0	5.5
6.5	6.0	5.6	6.5												
3.7	3.0	3.7	4.7	2.3	2.7	5.7	37.4	5.3	5.5	4.3	3.6	6.0	6.2	3.2	2.0
5.0	4.3	2.0	3.0												
6.7	5.7	5.7	5.7	3.0	5.3	7.0	101.8	6.0	6.2	6.0	6.0	6.2	5.8	3.8	3.0
6.0	6.7	5.7	6.0												
4.0	6.7	4.7	6.7	5.7	5.3	5.7	192.5	6.3	6.2	6.0	6.2	6.0	4.0	3.9	4.0
5.0	6.3	6.3	4.8												
6.0	6.7	6.3	6.7	6.3	2.7	4.7	266.9	5.8	6.0	5.8	4.2	5.0	6.7	3.7	6.0
5.5	6.0	5.0	5.3												
5.0	4.7	3.7	4.7	6.3	5.3	6.3	131.0	5.0	5.3	5.5	5.4	5.8	5.3	3.0	3.0
6.0	6.3	6.3	6.3												
5.7	3.3	6.0	6.0	7.0	5.0	7.0	209.9	7.0	6.0	7.0	5.8	6.0	7.0	3.7	5.5
6.5	6.7	7.0	6.8												
3.7	7.0	4.0	5.0	5.7	1.7	5.3	147.7	6.5	6.5	5.5	4.4	5.3	5.0	2.7	7.0
4.0	5.7	6.7	6.8												
6.0	5.7	6.7	4.3	6.0	6.0	6.7	158.7	6.0	6.2	6.0	6.0	4.2	3.5	3.7	6.0
6.0	5.7	6.0	6.0												
4.3	2.7	6.3	4.7	6.0	4.3	6.7	124.1	6.5	6.5	6.3	5.4	4.8	4.5	3.9	6.5
6.0	5.8	7.0	7.0												
4.7	5.0	7.0	7.0	6.0	1.0	7.0	233.2	6.3	6.2	6.3	5.0	4.8	4.5	3.1	6.0
6.0	6.0	4.6	6.0												

5.7	4.0	7.0	4.3	6.0	4.3	5.7	144.3	4.5	5.2	5.8	4.8	5.0	6.0	3.7	3.0
5.5	5.7	5.0	5.5												
2.0	1.3	5.3	5.3	5.3	5.0	6.3	82.0	5.8	5.7	5.8	5.0	4.7	6.0	3.6	5.5
6.0	6.0	6.0	6.0												
3.0	6.3	4.7	5.0	4.7	1.7	6.7	108.7	5.5	5.5	3.3	4.8	4.2	3.8	3.2	5.5
5.0	6.0	6.0	4.5												
3.7	3.7	4.0	4.3	5.3	2.7	5.3	87.1	2.8	4.3	4.8	3.8	5.7	4.2	2.9	3.0
2.5	3.3	3.8	4.3												
3.3	3.3	4.7	4.3	5.0	4.3	5.3	81.7	5.3	5.5	4.8	4.4	5.3	5.3	3.8	3.0
4.5	4.3	5.0	4.5												
3.0	2.0	7.0	6.7	4.0	3.3	5.7	106.6	6.0	5.0	5.5	6.0	5.8	5.8	3.1	4.5
5.5	6.0	5.7	5.8												
4.7	2.7	6.3	4.0	4.3	2.0	7.0	78.8	5.5	5.7	5.5	5.0	5.7	6.5	3.1	2.5
6.0	6.6	6.0	6.8												
6.3	4.3	6.0	3.7	3.0	3.0	6.7	61.0	5.3	5.3	5.3	1.4	6.2	5.2	4.2	5.0
5.5	5.7	4.7	3.0												
6.7	4.3	7.0	4.3	6.0	3.7	6.7	155.8	5.8	6.0	5.8	3.6	6.2	6.0	2.9	2.5
5.5	5.0	4.7	4.5												
6.7	4.0	7.0	4.7	4.0	3.0	7.0	109.7	4.5	4.0	4.0	3.0	3.8	5.3	3.6	2.5
4.0	3.7	2.0	4.0												
6.3	4.3	6.7	6.0	6.7	6.0	6.3	230.7	6.3	5.3	6.0	5.0	6.2	4.0	3.6	3.0
6.0	5.0	3.3	4.5												
5.3	2.3	6.7	5.7	3.7	3.3	6.7	98.9	6.3	6.5	3.3	5.2	6.2	5.8	2.8	6.0
6.0	6.0	5.7	6.0												
4.7	5.3	5.7	5.7	6.0	5.7	6.7	177.2	5.8	5.7	6.0	4.4	5.2	4.7	3.8	3.0
3.0	6.0	3.0	5.3												
2.7	5.0	6.7	5.0	6.7	7.0	7.0	159.0	5.8	6.5	5.8	6.0	6.3	6.3	2.8	5.0
6.0	6.3	6.7	5.8												
6.3	3.7	6.3	6.3	6.3	5.7	7.0	218.0	6.3	6.0	6.0	5.8	5.8	5.3	3.3	6.0
4.5	6.0	6.0	5.3												
4.7	5.0	6.7	5.7	6.3	4.7	6.3	194.9	6.3	5.7	6.0	6.0	5.7	5.0	2.8	6.0
6.0	5.3	6.0	5.8												
5.3	2.0	4.7	5.7	4.0	2.7	6.7	90.5	5.8	6.2	4.0	3.8	5.5	6.7	3.1	3.0
2.5	4.3	2.3	4.3												
6.3	4.0	6.3	6.7	4.7	1.3	7.0	172.4	6.0	6.0	6.3	4.6	5.7	6.3	3.7	4.0
1.0	6.3	3.7	5.8												
4.3	4.0	5.0	5.0	4.3	4.3	6.3	96.2	5.0	5.7	4.8	4.6	5.3	5.8	3.0	6.0
5.5	5.7	5.3	4.5												
6.3	3.7	4.7	6.7	5.3	3.7	7.0	173.4	5.5	5.2	4.3	6.0	5.7	7.0	3.2	6.0
5.0	6.0	5.3	6.0												
4.3	6.3	6.7	6.3	5.7	5.3	6.3	206.9	6.3	6.2	5.8	4.8	6.0	6.2	4.1	1.5
7.0	5.7	2.7	4.3												
6.3	7.0	6.3	6.3	6.7	5.7	6.3	276.4	6.3	5.7	6.0	6.4	6.3	6.2	3.2	6.0
6.5	6.3	5.7	6.3												
6.7	5.7	7.0	6.0	5.7	7.0	7.0	218.7	6.3	6.7	5.0	6.4	6.7	6.8	3.8	5.0
6.5	6.3	5.3	6.5												
5.0	4.0	6.0	6.0	6.0	4.7	6.3	180.0	6.0	5.5	6.0	6.2	6.0	4.7	3.8	7.0
6.5	6.0	6.0	5.8												
6.3	4.7	7.0	5.3	3.7	4.3	6.3	117.0	4.5	4.8	6.0	6.4	5.5	5.8	2.9	2.0
6.5	6.0	6.7	5.0												
6.0	6.0	6.7	3.7	4.3	4.3	7.0	98.0	6.3	5.3	5.3	6.0	5.0	2.8	3.2	6.0
6.5	5.0	5.0	5.3												
4.7	4.0	6.7	5.7	4.0	6.0	6.7	115.0	5.8	5.5	5.0	6.0	5.0	4.0	2.6	5.0
5.5	6.3	6.0	5.8												
4.7	3.3	7.0	3.7	3.0	3.3	5.3	54.9	4.3	6.2	4.0	4.6	5.5	6.8	3.3	1.0
4.5	4.3	6.0	5.0												
4.3	2.7	5.3	3.7	2.0	1.0	5.7	30.1	5.8	5.5	2.3	6.2	5.2	4.7	2.8	6.0
6.0	6.0	4.0	4.5												
3.7	3.0	4.7	3.7	3.3	1.3	6.0	46.0	4.8	5.0	3.0	5.2	4.3	5.5	2.8	3.5
6.5	6.0	5.3	4.8												
3.0	4.3	6.0	5.3	6.0	4.3	6.7	142.1	5.5	6.2	6.0	5.6	6.2	4.3	3.2	6.0
6.2	6.0	6.0	5.8												
4.7	6.0	4.3	4.0	5.7	2.0	5.3	113.1	6.0	6.0	5.0	6.2	5.2	4.0	3.3	6.0
6.0	6.0	4.7	5.3												
3.7	5.3	4.3	5.3	4.7	4.0	5.3	110.3	6.0	5.8	3.3	6.2	5.3	4.0	3.1	6.5
6.5	6.0	6.3	5.8												
4.7	4.0	6.3	3.7	4.3	3.3	6.3	79.2	5.0	5.5	5.5	5.2	4.8	2.2	2.5	6.0
2.0	5.3	5.3	6.3												
5.0	3.7	6.7	4.7	6.0	5.0	6.7	142.8	6.0	4.8	4.5	5.6	5.0	5.0	3.2	6.0
4.5	5.7	6.3	5.5												
4.7	3.7	5.0	4.0	4.3	4.0	6.0	76.9	4.8	5.2	6.0	5.6	5.8	5.0	3.0	6.0
6.5	5.7	5.7	5.0												
5.7	5.3	5.7	5.3	6.0	4.0	6.0	177.5	6.0	6.0	5.5	5.8	6.0	5.0	3.3	6.0
6.0	6.0	6.0	6.0												
5.3	4.7	4.7	4.3	5.0	4.0	6.0	105.7	6.3	5.8	4.0	6.2	6.3	5.2	3.0	6.0
6.5	6.0	5.7	6.0												
4.3	6.0	6.3	4.7	6.0	3.0	5.3	155.3	6.5	6.2	0.0	6.4	0.0	5.2	2.7	5.5
7.0	6.0	3.7	4.3												

MEANS

5.03667	4.52366	5.72033	5.31894	5.16203	4.11081	0.09984	145.73333
5.57520	5.64927	5.10772	5.10732	5.32610	5.33138	3.30577	4.53659
5.60569	5.74732	5.36122	5.42902				

STANDARD DEVIATIONS

1.33449	1.37907	1.11558	0.92898	1.16681	1.39649	0.81693	62.21392
1.05627	1.00612	1.23519	1.16803	1.09959	1.09282	0.44771	1.50180
1.03078	0.66116	1.27129	1.00143				

CORRELATION COEFFICIENTS

ROW 1	1.00000	0.30153	0.38832	0.25889	0.18080	-0.12303	0.31216	0.51332	0.26659	0.19052
	0.22033	0.09483	0.23156	0.31992	0.29401	-0.17279	-0.04068	-0.00435	-0.10637	0.03852
ROW 2	0.30153	1.00000	0.09460	-0.20215	0.28846	0.14883	-0.02072	0.51452	0.08693	0.07951
	0.20112	0.06756	-0.04452	-0.01553	0.12544	0.02429	0.03202	0.15234	-0.00422	0.07515
ROW 3	0.38832	0.09460	1.00000	0.20652	0.30425	-0.19077	0.43487	0.47440	0.27746	0.25509
	0.24919	0.11479	0.13969	0.15651	0.21600	-0.04842	0.09324	0.10257	0.03214	0.09717
ROW 4	0.25889	0.20215	0.20652	1.00000	0.41071	0.28596	0.18448	0.73280	0.31907	0.31517
	0.34916	0.28252	0.14920	0.19080	0.10868	0.07796	-0.02556	0.25079	0.24447	0.19135
ROW 5	0.18080	0.28846	0.30425	0.41071	1.00000	0.41880	0.23128	0.79526	0.39185	0.39122
	0.51370	0.27330	0.22575	0.10699	0.21110	0.14441	0.10934	0.13233	0.27017	0.26684
ROW 6	0.12303	0.14883	0.19077	0.28596	0.41880	1.00000	0.14992	0.39116	0.25053	0.22319
	0.38374	0.31650	0.20402	0.06331	0.04595	0.11801	0.20479	0.20199	0.37345	0.33231
ROW 7	0.31216	-0.02072	0.43487	0.18448	0.23128	0.14992	1.00000	0.29292	0.23561	0.13658
	0.25418	0.07927	0.14261	0.15491	0.11286	0.08668	-0.00284	0.14814	-0.00829	0.20005
ROW 8	0.51332	0.51452	0.47440	0.73280	0.79526	0.39116	0.29292	1.00000	0.41637	0.39833
	0.49477	0.28817	0.21001	0.22676	0.25961	0.06638	0.07520	0.21007	0.21566	0.25663
ROW 9	0.26659	0.08693	0.27746	0.31907	0.39185	0.25053	0.23561	0.41637	1.00000	0.79064
	0.56230	0.71558	0.51330	0.06570	0.07231	0.17408	0.15073	0.24806	0.19161	0.21278
ROW 10	0.19052	0.07951	0.25909	0.31517	0.39122	0.22319	0.13658	0.39833	0.79064	1.00000
	0.58071	0.60860	0.53218	0.13125	0.09450	0.12787	0.07966	0.14010	0.18900	0.11696
ROW 11	0.22033	0.20112	0.24919	0.34916	0.51370	0.38374	0.25418	0.49477	0.56230	0.58071
	1.00000	0.44018	0.62658	0.07256	0.22290	0.06274	-0.04362	0.12203	0.20452	0.19847
ROW 12	0.09483	0.06756	0.11479	0.28282	0.27330	0.31650	0.07927	0.26817	0.71558	0.60860
	0.44018	1.00000	0.31048	-0.02754	-0.15795	0.28764	0.28461	0.36407	0.46347	0.31566
ROW 13	0.23156	-0.04452	0.13969	0.14920	0.22575	-0.20402	0.14261	-0.21001	0.51330	0.58218
	0.62658	0.31048	1.00000	0.18223	0.19685	-0.03586	-0.04122	-0.05599	-0.00843	0.01471
ROW 14	0.31992	-0.01553	0.15651	0.19080	0.10699	-0.06331	0.15491	0.22676	-0.06570	0.13125
	0.07256	-0.02754	0.18223	1.00000	0.31326	-0.21504	-0.03415	0.11763	-0.01432	0.04157
ROW 15	0.29401	0.12544	0.21600	0.10888	0.21110	-0.04595	0.11286	0.25961	0.07231	0.09450
	0.22290	-0.15795	0.19685	0.31326	1.00000	-0.17573	-0.07415	-0.08734	-0.23400	-0.23219
ROW 16	-0.17279	0.02429	-0.04842	0.07796	0.14441	0.11801	0.08668	0.06638	0.17408	0.12787
	0.06274	0.28764	-0.03586	-0.21504	-0.17573	1.00000	0.25088	0.35222	0.35063	0.25504
ROW 17	-0.04068	0.03202	0.09324	-0.02556	0.10934	0.20479	-0.00284	0.07520	0.15073	0.07966
	-0.04362	0.28461	-0.04122	-0.03415	-0.07415	0.25088	1.00000	0.33808	0.33827	0.24364
ROW 18	-0.00435	0.15234	0.10257	0.25079	0.13233	0.20199	0.14814	0.21007	0.24806	0.14010
	0.12203	0.36407	-0.05599	0.11763	-0.08734	0.35222	0.33808	1.00000	0.54265	0.44156
ROW 19	-0.10637	-0.00422	0.03214	0.24447	0.27017	0.37345	-0.00829	0.21566	0.19161	0.18900
	0.20452	0.48347	-0.00843	-0.01432	-0.23400	0.35063	0.33827	0.54265	1.00000	0.54142
ROW 20	0.03852	0.07515	0.09717	0.19135	0.26684	0.33231	0.20005	0.25663	0.21278	0.11696
	0.19847	0.31566	0.01471	0.04157	-0.23219	0.25504	0.24364	0.44156	0.54142	1.00000

EIGENVALUES

5.48852	2.79205	1.87177	1.30242	1.06950	1.00957

CUMULATIVE PERCENTAGE OF EIGENVALUES

0.27443	0.41403	0.50762	0.57274	0.62621	0.67669

EIGENVECTORS

VECTOR 1

0.17841	0.13323	0.19853	0.25918	0.30120	0.23375	0.16379	0.34300	0.32183	0.30313
0.31183	0.28187	0.21241	0.09477	0.07629	0.09942	0.09616	0.17763	0.19039	0.18707

VECTOR 2

-0.30811	-0.08899	-0.18116	-0.05812	-0.05875	0.09166	-0.11648	-0.15689	0.00829	-0.03794
-0.10342	0.22947	-0.17168	-0.21861	-0.35944	0.33833	0.28060	0.31283	0.39964	0.29804

VECTOR 3

-0.17212	-0.30218	-0.16355	-0.18875	-0.14914	-0.10488	-0.12919	-0.29229	0.33237	0.30180
0.22351	0.26684	0.43493	-0.12579	-0.07454	-0.00462	-0.09439	-0.19961	-0.10237	-0.18516

VECTOR 4

0.16353	-0.46654	0.33107	-0.17460	-0.25320	-0.07916	0.46921	-0.21683	0.05080	-0.01850
-0.14032	-0.00070	0.05462	0.36265	0.04318	-0.03007	0.18581	0.20533	0.03631	0.15647

VECTOR 5

-0.03090	-0.06236	-0.36738	0.13669	-0.07398	0.10830	-0.46191	-0.04152	-0.03545	0.01627
-0.01720	0.02695	0.12008	0.60659	0.21452	-0.29131	0.05271	0.18185	0.22254	0.04486

VECTOR 6

0.27538	0.39886	0.06217	-0.14734	-0.20814	-0.35045	-0.21593	0.00086	0.21749	0.14649
-0.21774	0.20180	-0.10909	0.00686	0.13732	0.10258	0.43977	0.20968	-0.15298	-0.26029

FACTOR MATRIX (6 FACTORS)

VARIABLE 1					
0.41797	-0.51483	-0.23548	0.18663	-0.03196	0.27669
VARIABLE 2					
0.31213	-0.14870	-0.41342	-0.53243	-0.06449	0.40076
VARIABLE 3					
0.46512	-0.30271	-0.22376	0.37783	-0.37993	0.06247
VARIABLE 4					
0.69719	-0.09711	-0.25823	-0.19925	0.14136	-0.14804
VARIABLE 5					
0.70564	-0.09817	-0.20404	-0.28896	-0.07651	-0.20913
VARIABLE 6					
0.54762	0.15316	-0.14349	-0.09034	0.11201	-0.35213
VARIABLE 7					
0.38372	-0.19460	-0.17675	0.53548	-0.47769	-0.21696
VARIABLE 8					
0.80356	-0.26216	-0.39987	-0.24742	-0.04294	0.00086
VARIABLE 9					
0.75397	0.01385	0.45473	0.05797	-0.08837	0.21853
VARIABLE 10					
0.71016	-0.06340	0.52208	-0.02111	0.01683	0.14719
VARIABLE 11					
0.73054	-0.17281	0.30578	-0.16014	-0.01778	-0.21878
VARIABLE 12					
0.66036	0.38343	0.36507	-0.00079	0.02787	0.20276
VARIABLE 13					
0.49762	-0.28687	0.59503	0.06234	0.12418	-0.10961
VARIABLE 14					
0.22203	-0.36528	-0.17210	0.43669	0.62731	0.00690
VARIABLE 15					
0.17873	-0.60061	-0.10198	0.04928	0.22185	0.13797
VARIABLE 16					
0.23291	0.56532	-0.00632	-0.04344	-0.30126	0.10307
VARIABLE 17					
0.22529	0.46836	-0.12914	0.21205	0.05451	0.44187
VARIABLE 18					
0.41614	0.52272	-0.27309	0.23433	0.18807	0.21068
VARIABLE 19					
0.44603	0.66777	-0.14006	0.04144	0.23014	-0.15371

VARIABLE 20					
0.43825	0.49801	-0.25352	0.17913	0.04639	-0.26153

ITERATION CYCLE	VARIANCES
0	0.168236
1	0.409377
2	0.447633
3	0.454103
4	0.455196
5	0.455445
6	0.455509
7	0.455527
8	0.455532
9	0.455533
10	0.455534
11	0.455534
12	0.455534
13	0.455534
14	0.455534

ROTATED FACTOR MATRIX (6 FACTORS)

VARIABLE 1					
0.02105	-0.01183	0.16864	0.46657	0.44241	0.40642
VARIABLE 2					
0.16695	0.05668	-0.02385	-0.03498	-0.01318	0.83963
VARIABLE 3					
0.10056	0.06001	0.14553	0.75461	0.12662	0.16937
VARIABLE 4					
0.59990	0.08084	0.17907	0.08933	0.17257	0.30025
VARIABLE 5					
0.66773	-0.00286	0.27381	0.19463	-0.02145	0.35084
VARIABLE 6					
0.65586	0.16265	0.16983	0.05552	0.00629	-0.00800
VARIABLE 7					
0.17747	0.02136	0.07068	0.84924	0.00771	-0.14193
VARIABLE 8					
0.62547	0.06419	0.23391	0.32040	0.17448	0.59519
VARIABLE 9					
0.10249	0.22588	0.84750	0.19663	-0.02176	0.12431
VARIABLE 10					
0.13328	0.10538	0.87023	0.07896	0.04273	0.09526
VARIABLE 11					
0.48333	-0.11940	0.67670	0.13079	0.02439	0.08597
VARIABLE 12					
0.16433	0.48094	0.66706	-0.02839	-0.15882	0.04327
VARIABLE 13					
0.13000	-0.19318	0.77064	0.05172	0.20900	-0.14437
VARIABLE 14					
0.12330	0.13002	0.03422	0.08323	0.86330	-0.10542
VARIABLE 15					
0.00254	-0.23263	0.11193	0.14736	0.55713	0.27385
VARIABLE 16					
0.08919	0.44586	0.10461	0.06531	-0.50364	0.03919
VARIABLE 17					
-0.12303	0.70335	0.06268	0.03402	-0.04422	0.11634
VARIABLE 18					
0.21037	0.77663	0.03297	0.05378	0.04896	0.04330
VARIABLE 19					
0.50195	0.65063	0.06867	-0.13909	-0.13121	-0.15108
VARIABLE 20					
0.52169	0.51969	-0.00874	0.14008	-0.11307	-0.17879

CHECK ON COMMUNALITIES

VARIABLE	ORIGINAL	FINAL	DIFFERENCE
1	0.60751	0.60751	0.00000
2	0.73871	0.73870	0.00000
3	0.64905	0.64905	0.00000
4	0.52639	0.52639	0.00000
5	0.68228	0.68228	0.00000
6	0.48864	0.48864	0.00000
7	0.77835	0.77835	0.00000
8	0.93740	0.93740	0.00000
9	0.83437	0.83437	0.00000
10	0.80330	0.80330	0.00000
11	0.73088	0.73088	0.00000
12	0.75826	0.75826	0.00000
13	0.71530	0.71530	0.00000
14	0.79661	0.79661	0.00000
15	0.47375	0.47375	0.00000
16	0.47714	0.47714	0.00000
17	0.53044	0.53044	0.00000
18	0.65565	0.65565	0.00000
19	0.74278	0.74278	0.00000
20	0.60689	0.60689	0.00000

NUMBER OF GROUPS 9
NUMBER OF VARIABLES 20
SAMPLE SIZES..

GROUP	
1	5
2	7
3	15
4	16
5	13
6	8
7	30
8	31
9	21

GROUP 1 MEANS

5.99600	5.26400	6.19800	5.59600	5.53000	4.46400	6.33200	181.26000
6.05000	6.22800	5.60000	4.96000	5.43000	6.13200	3.93400	3.20000
5.90000	5.93200	4.99800	5.70000				

GROUP 2 MEANS

4.42571	4.42571	5.56714	4.71286	5.13857	3.66286	5.33000	121.20000
5.50000	5.75857	4.85714	4.94286	5.64000	5.16571	3.45000	4.92857
6.00000	5.99714	5.33000	6.03571				

GROUP 3 MEANS

4.72867	4.35200	6.06400	5.24133	5.12933	3.57467	6.06000	142.54000
4.81667	4.90467	4.45000	4.01333	4.94200	5.45333	3.35400	3.46667
5.33333	5.64067	5.22000	5.05000				

GROUP 4 MEANS

4.99625	4.28813	5.58063	5.33063	5.16313	4.45625	6.24088	138.96875
5.66750	5.67375	5.04688	5.37500	5.23563	5.16813	3.19688	5.31250
5.84375	6.06000	5.99438	5.34375				

GROUP 5 MEANS

5.43154	4.67538	5.61308	5.81692	5.07385	4.27923	5.97154	163.72308
5.71154	5.83077	5.23077	5.60769	5.08615	5.76692	3.46077	4.33769
5.65385	5.61231	5.56077	5.67308				

GROUP 6 MEANS

4.78750	4.99500	5.03750	5.78875	5.41250	4.20500	5.41250	160.62500
5.65625	5.87000	5.76125	5.12500	5.62375	5.08250	3.15500	4.62500
5.87500	5.70500	5.49875	5.37500				

GROUP 7 MEANS

4.96267	4.29667	5.67400	5.28467	5.20833	3.94100	6.31833	140.61000
5.63333	5.66133	5.40000	4.74000	5.49600	5.36067	3.35000	4.35000
5.11667	5.55000	4.84667	5.31733				

GROUP 8 MEANS

4.85774	4.30935	6.29839	4.90968	5.39484	4.95323	6.33032	138.79677
6.12097	6.13161	5.54839	5.54839	5.79806	4.86639	2.89871	5.38710
5.51613	6.23484	5.94355	5.83065				

GROUP 9 MEANS

4.93238	4.63190	5.82190	4.91667	4.85429	4.02952	6.18762	129.36667
5.64286	5.54714	4.61905	5.80952	5.29095	5.05238	3.12429	5.19048
6.07143	5.82333	5.37762	5.39286				

POOLED DISPERSION MATRIX

ROW 1

1.71170	0.52006	0.55098	0.19531	0.26652	0.15325	0.30651	30.56693
0.34882	0.17456	0.30362	0.11947	0.28909	0.46498	0.15161	-0.23621
0.01152	0.02034	-0.17419	0.07301				

ROW 2

0.52006	2.05344	0.08884	0.12196	-0.40267	0.21935	0.00080	42.10848
0.13406	0.06506	0.35960	0.02097	-0.04314	0.04769	0.07156	0.02165
0.22095	0.13403	0.04741	0.08331				

ROW 3

	0.55098	0.08884	1.16695	0.28020	0.38911	0.32747	0.32457	27.23550
	0.35461	0.30783	0.36848	0.18538	0.18759	0.21068	0.06484	-0.02322
	0.18548	0.10969	0.05291	0.12939				
ROW 4								
	0.19531	0.12196	0.28020	1.00451	0.35375	0.35557	0.07481	30.88371
	0.30925	0.25429	0.30938	0.37465	0.19226	0.13731	0.01552	0.13672
	0.05425	0.16898	0.26469	0.23415				
ROW 5								
	0.26652	0.40267	0.38911	0.35375	1.33102	0.69068	0.20978	46.44091
	0.40101	0.40187	0.65552	0.37409	0.26015	0.23639	0.06963	0.36367
	0.21462	0.08406	0.42617	0.27442				
ROW 6								
	0.15325	0.21935	0.32747	0.35557	0.69068	1.87279	0.16790	28.82701
	0.32100	0.25448	0.54967	0.40280	0.28139	0.17742	0.02995	0.23182
	0.33972	0.14623	0.61349	0.40807				
ROW 7								
	0.30651	0.00080	0.32957	0.07281	0.20978	0.16790	0.59443	10.06407
	0.16910	0.10289	0.21379	0.01793	0.10926	0.19118	0.03031	0.03988
	0.06166	0.07701	-0.01344	0.16828				
ROW 8								
	30.56693	42.10848	-27.23550	30.88371	46.44091	28.82701	10.06407	3606.73623
	23.88716	21.90602	28.87931	16.99652	13.66156	11.65891	6.62631	6.36070
	14.66859	8.88052	16.61417	12.79435				
ROW 9								
	0.34882	0.13406	0.35461	0.30925	0.40101	0.32100	0.18910	23.88716
	0.93825	0.57857	0.59724	0.66313	0.52325	0.07997	0.05750	0.21347
	0.12246	0.14840	0.19063	0.17501				
ROW 10								
	0.17456	0.06506	0.30783	0.25429	0.40187	0.25448	0.10289	21.90602
	0.67857	0.87036	0.54642	0.55947	0.56933	0.18745	0.05583	0.21369
	0.07009	0.07903	0.24471	0.07923				
ROW 11								
	0.30362	0.35960	0.36848	0.30938	0.65552	0.54967	0.21379	28.87931
	0.59724	0.54642	1.32428	0.59169	0.72676	0.11469	0.10269	0.17141
	0.03656	0.10573	0.30864	0.20950				
ROW 12								
	0.11947	0.02097	0.18538	0.37465	0.37409	0.40280	0.01793	16.99652
	0.66313	0.55947	0.59169	1.05437	0.38796	0.03041	-0.03482	0.40437
	0.16009	0.20759	0.59487	0.31513				
ROW 13								
	0.28904	-0.04314	0.18759	0.19228	0.26015	0.28139	0.10926	13.66156
	0.52325	0.56933	0.72676	0.38796	1.08967	0.25790	0.09611	0.00643
	0.00981	-0.01329	0.04728	0.02377				
ROW 14								
	0.46498	0.04769	0.21068	0.13731	0.23639	0.17742	0.19118	11.65891
	0.07997	0.10745	0.11469	0.03641	0.25790	1.34030	0.12670	-0.07176
	-0.00012	0.10720	0.06543	0.03853				
ROW 15								
	0.15161	0.07156	0.08484	0.01552	0.06963	0.02995	0.03031	6.62631
	0.05750	0.05583	0.10269	-0.03482	0.09611	0.12870	0.18287	-0.03877
	0.00501	-0.00203	-0.08867	-0.09864				
ROW 16								
	-0.23621	0.02165	-0.02322	0.18872	0.36367	-0.23182	-0.03988	6.36070
	0.21347	0.21369	0.17141	0.40437	0.00643	-0.07176	-0.03877	2.15691
	0.22338	0.30410	0.67504	0.41179				
ROW 17								
	0.01152	0.22095	0.18548	0.05425	0.21462	-0.33972	0.06166	14.66859
	0.12246	0.07009	0.03656	0.16009	0.00981	-0.00012	0.00501	0.22338
	1.06705	0.16847	0.41614	0.19995				
ROW 18								
	0.02034	0.13403	0.10969	0.18898	-0.08406	0.14623	-0.07701	8.88052
	0.14840	0.07903	0.10573	0.20759	-0.01329	0.10720	-0.00203	0.30410

```
          0.16847         0.40187         0.36676         0.25534

ROW 19
         -0.17419         0.04741         0.05291         0.26469         0.42617         0.61349        -0.01344        16.61417
          0.19063         0.24471         0.30864         0.59487         0.04728         0.06543        -0.08867         0.67504
          0.41614         0.36876         1.49024         0.63803

ROW 20
          0.07301         0.08331         0.12939         0.23415         0.27442         0.40807         0.16628        12.79835
          0.17501         0.07923         0.20950         0.31513         0.02377         0.03853        -0.09664         0.41179
          0.19995         0.25534         0.63803         0.89825

BASE RATES IN SERIAL ORDER ARE A PRIORI
  1.000   1.000   1.000   1.000   1.000

BASE RATES IN SERIAL ORDER ARE A PRIORI
  1.000   1.000   1.000   1.000

COMMON MEANS
          4.95747         4.46363         5.83021         5.21096         5.19082         4.23664         6.13616       142.24247
          5.67637         5.72925         5.16952         5.17603         5.42034         5.24233         3.22932         4.70548
          5.59932         5.84849         5.44774         5.49500

GENERALIZED MAHALANOBIS D-SQUARE      362.71555

                D-SQUARED IS DISTRIBUTED AS CHI-SQUARED WITH D. F.
                        EQUAL TO    160

DISCRIMINANT FUNCTION  1
     CONSTANT     *     COEFFICIENTS
   -176.95470     *          0.99292         5.51978         1.23346         7.22305         7.01579        -1.17934         8.45415
                             -0.30700        -4.49301         8.27004        -4.89568         1.91482         3.34622        -1.52471
                             28.52512        -2.27154         3.92017        10.76823        -0.14991         5.80532

DISCRIMINANT FUNCTION  2
     CONSTANT     *     COEFFICIENTS
   -165.21709     *          0.51880         5.45529         1.95069         6.22200         7.71544        -1.56211         6.72669
                             -0.30952        -4.70097         7.20807        -5.76132         2.17225         5.25590        -1.91452
                             26.72104        -1.46654         3.89756        11.55178        -0.53253         6.41249

DISCRIMINANT FUNCTION  3
     CONSTANT     *     COEFFICIENTS
   -150.82074     *          0.36534         5.40405         2.32478         7.11799         7.42294        -1.66320         8.58742
                             -0.29407        -4.05682         5.48527        -5.70786         1.50299         4.97832        -1.65443
                             24.96059        -1.91311         3.11023        10.45444         1.16119         4.12003

DISCRIMINANT FUNCTION  4
     CONSTANT     *     COEFFICIENTS
   -156.52536     *          1.03734         5.23056         1.25895         6.83773         6.82299        -1.01066        -9.31082
                             -0.29541        -4.37622         6.53203        -5.36134         2.56945         4.40080        -1.92952
                             24.16172        -1.16336         3.52943        11.01305         0.81443         3.54214

DISCRIMINANT FUNCTION  5
```

CONSTANT	*	COEFFICIENTS						
-155.64118	*	0.90661	5.29665	1.12560	7.35261	6.13237	-1.21884	8.62294
		-0.28713	-4.76018	7.09228	-4.89529	3.33347	3.34068	-1.27586
		26.21301	-1.54689	3.67680	8.88279	0.26979	5.11929	

DISCRIMINANT FUNCTION 6

CONSTANT	*	COEFFICIENTS						
-144.93154	*	1.00279	5.25314	0.70825	7.56146	6.84841	-1.29991	7.33796
		-0.29277	-4.26223	7.15699	-3.93757	1.37340	4.05964	-1.65959
		23.25760	-1.40281	4.10292	10.27432	0.17454	4.47429	

DISCRIMINANT FUNCTION 7

CONSTANT	*	COEFFICIENTS						
-151.65592	*	0.61816	5.22876	1.36742	6.99191	6.87082	-1.29453	9.01457
		-0.29375	-4.02231	6.62367	-4.74555	1.91803	4.27364	-1.63275
		24.76039	-1.40886	3.20299	9.97159	0.15684	4.66024	

DISCRIMINANT FUNCTION 8

CONSTANT	*	COEFFICIENTS						
-155.11052	*	0.79487	5.30142	2.20021	5.81018	6.97533	-0.69329	8.72104
		-0.29439	-4.24222	6.86606	-5.40145	2.19248	5.11393	-2.16136
		21.94872	-1.17858	2.92864	12.11406	0.28376	4.17439	

DISCRIMINANT FUNCTION 9

CONSTANT	*	COEFFICIENTS						
-157.98339	*	0.63847	5.73026	1.92512	6.20390	6.74711	-1.17110	9.49343
		-0.29249	-5.32831	6.31647	-6.41550	4.65803	5.08606	-1.90122
		24.41216	-1.12407	3.77989	10.32692	-0.19283	4.23287	

EVALUATION OF CLASSIFICATION FUNCTIONS FOR EACH OBSERVATION

GROUP 1

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.97692	1
2	0.27117	5
3	0.91357	1
4	0.91541	1
5	0.25336	5

PRODUCT OF PROBABILITIES WITHIN GROUP IS 0.05813

GROUP 2

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.63991	2
2	0.52705	2
3	0.32919	3
4	0.42299	5
5	0.90507	2
6	0.91076	2
7	0.93203	2

PRODUCT OF PROBABILITIES WITHIN GROUP IS 0.403608

GROUP 3

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.56719	7
2	0.42934	3
3	0.35770	3
4	0.31010	5
5	0.21198	7
6	0.96096	3
7	0.37322	8
8	0.96716	3
9	0.49039	7
10	0.93215	3
11	0.36212	5
12	0.52578	3
13	0.99612	3
14	0.99186	3
15	0.72721	3

PRODUCT OF PROBABILITIES WITHIN GROUP IS
0.00012

GROUP 4

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.62871	4
2	0.34761	6
3	0.73713	9
4	0.42524	6
5	0.45044	4
6	0.35181	4
7	0.32010	3
8	0.59155	4
9	0.44664	4
10	0.33513	5
11	0.31428	6
12	0.79600	8
13	0.41874	7
14	0.68254	4
15	0.51576	9
16	0.90647	4

PRODUCT OF PROBABILITIES WITHIN GROUP IS
0.00001

GROUP 5

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.41141	5
2	0.43571	6
3	0.43692	7
4	0.60908	9
5	0.49728	5
6	0.60561	5
7	0.44419	7
8	0.39517	5
9	0.47488	5
10	0.89514	5
11	0.32310	5
12	0.52901	5
13	0.78206	5

PRODUCT OF PROBABILITIES WITHIN GROUP IS
0.00017

GROUP 6

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.38918	6
2	0.55011	6
3	0.47715	6
4	0.47038	1
5	0.39201	6
6	0.37852	3
7	0.95206	6
8	0.67617	6

PRODUCT OF PROBABILITIES WITHIN GROUP IS
0.00367

GROUP 7

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.63042	6
2	0.39054	7
3	0.53246	7
4	0.69062	1
5	0.33803	4
6	0.81311	6
7	0.33203	4
8	0.39221	7
9	0.67366	6
10	0.24361	9
11	0.33257	7
12	0.59424	7
13	0.30651	2

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
14	0.50015	7
15	0.40474	4
16	0.50912	7
17	0.39303	7
18	0.40119	3
19	0.29773	2
20	0.66366	7
21	0.54649	7
22	0.53901	7
23	0.42501	7
24	0.35591	9
25	0.54401	7
26	0.77077	8
27	0.57375	4
28	0.27677	9
29	0.87321	7
30	0.84613	7

PRODUCT OF PROBABILITIES WITHIN GROUP IS
0.00000

GROUP 8

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.73909	8
2	0.41288	8
3	0.73480	8
4	0.44541	8
5	0.72761	8
6	0.41401	8
7	0.87243	8
8	0.66103	8
9	0.73644	8
10	0.86661	8
11	0.72091	8
12	0.32578	8
13	0.93485	8
14	0.54313	8
15	0.77954	8
16	0.87833	8
17	0.46465	8
18	0.36013	8
19	0.91503	9
20	0.70811	8
21	0.93251	8
22	0.40473	8
23	0.27461	4
24	0.50601	7
25	0.33443	7
26	0.84499	8
27	0.77741	8
28	0.91073	8
29	0.73965	8
30	0.71114	8
31	0.92263	8

PRODUCT OF PROBABILITIES WITHIN GROUP IS
0.00000

GROUP 9

OBSERVATION	PROBABILITY ASSOCIATED WITH LARGEST DISCRIMINANT FUNCTION	LARGEST FUNCTION NO.
1	0.55135	4
2	0.35474	9
3	0.89111	1
4	0.62237	9
5	0.72835	9
6	0.33152	4
7	0.53150	9
8	0.92384	9
9	0.59149	9
10	0.43164	9
11	0.98935	9
12	0.75088	9
13	0.35433	9
14	0.47202	9
15	0.80513	9

16	0.56625	8
17	0.27698	8
18	0.38968	9
19	0.24753	9
20	0.81827	9
21	0.98433	9

PRODUCT OF PROBABILITIES WITHIN GROUP IS
0.00000

APPENDIX 3

AGE AND EDUCATION TABLES – UNITED STATES SAMPLES

Table 17

JDS Means and Standard Deviations by Age

Variable	<20		20-29		30-39		40-49		50-59		60+		F	p
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.		
Skill variety	3.18	1.42	4.11	1.55	4.90	1.46	5.09	1.37	4.97	1.46	4.88	1.40	149.5	.00
Task identity	4.32	1.51	4.59	1.45	4.76	1.43	4.73	1.39	4.74	1.40	4.77	1.29	7.0	.00
Task significance	5.06	1.33	5.36	1.31	5.58	1.19	5.79	1.10	5.62	1.11	5.35	1.36	27.5	.00
Autonomy	4.02	1.37	4.54	1.41	4.98	1.34	5.09	1.30	5.12	1.31	5.14	1.29	61.3	.00
Feedback from job	4.58	1.29	4.69	1.39	4.85	1.32	5.04	1.24	5.01	1.30	5.15	1.27	16.9	.00
Feedback from agents	4.13	1.58	4.02	1.60	4.12	1.54	4.20	1.54	4.16	1.61	4.30	1.70	3.1	.00
Dealing with others	5.03	1.29	5.33	1.36	5.62	1.24	5.63	1.24	5.60	1.22	5.16	1.46	22.4	.00
MPS	83.99	52.02	108.93	65.93	131.90	70.23	142.39	70.63	140.01	70.78	139.43	41.36	73.3	.00
Experienced meaningfulness	4.44	1.18	4.81	1.20	5.24	1.06	5.52	0.92	5.48	0.99	5.64	0.86	113.3	.00
Experienced responsibility	5.02	1.00	5.20	0.98	5.51	0.94	5.69	0.80	5.67	0.82	5.92	0.76	80.1	.00
Knowledge of results	4.96	1.12	4.97	1.17	5.08	1.13	5.12	1.11	5.17	1.12	5.40	0.87	7.7	.00
General satisfaction	4.25	1.26	4.32	1.26	4.73	1.26	5.08	1.10	5.18	1.12	5.44	0.86	108.9	.00
Internal motivation	5.28	0.92	5.31	0.96	5.60	0.84	5.75	0.70	5.72	0.75	5.86	0.72	62.6	.00
Pay satisfaction	3.94	1.67	3.89	1.66	4.23	1.67	4.53	1.61	4.64	1.48	4.77	1.58	42.4	.00
Security satisfaction	4.62	1.32	4.59	1.48	4.75	1.50	5.01	1.40	5.15	1.42	5.47	1.34	29.7	.00
Social satisfaction	5.24	1.09	5.15	1.06	5.38	1.01	5.50	0.93	5.55	0.85	5.54	0.91	32.0	.00
Supervisory satisfaction	4.88	1.42	4.60	1.59	4.74	1.62	5.15	1.41	5.15	1.50	5.67	1.03	34.7	.00
Growth satisfaction	4.18	1.36	4.44	1.40	4.86	1.28	5.19	1.13	5.20	1.07	5.41	1.11	92.0	.00
Would like GNS	5.55	1.16	5.78	1.17	5.74	1.19	5.56	1.19	5.23	1.27	5.10	1.34	33.3	.00
Job choice GNS	4.01	0.74	4.25	0.81	4.27	0.78	4.25	0.84	4.12	0.84	4.11	0.89	8.8	.00
Total GNS	4.78	0.81	5.02	0.85	5.01	0.84	4.91	0.85	4.67	0.89	4.60	0.91	26.8	.00
N (approx.)	269		2,741		1,641		971		740		112			

df = 5, 6468.

JDS Means and Standard Deviations by

Variable	Grade School $\bar{X}$	Grade School S.D.	Some High School $\bar{X}$	Some High School S.D.	High School Degree $\bar{X}$	High School Degree S.D.	Some Business School or Technical School $\bar{X}$	Some Business School or Technical School S.D.	Some College $\bar{X}$	Some College S.D.	Business School or Technical School Degree $\bar{X}$	Business School or Technical School Degree S.D.	College Degree $\bar{X}$	College Degree S.D.	Some Graduate Work $\bar{X}$	Some Graduate Work S.D.	Graduate Degree $\bar{X}$	Graduate Degree S.D.	F	p
Skill Variety	4.48	1.21	4.31	1.50	4.33	1.55	4.70	1.61	4.51	1.59	4.83	1.50	4.84	1.48	5.04	1.51	5.46	1.29	20.4	.00
Task Identity	4.73	1.05	4.65	1.36	4.59	1.40	4.75	1.47	4.68	1.49	4.65	1.52	4.72	1.38	4.81	1.59	4.99	1.50	2.6	.01
Task Significance	5.12	1.33	5.44	1.18	5.51	1.23	5.63	1.20	5.47	1.31	5.47	1.24	5.38	1.22	5.48	1.38	5.51	1.24	2.9	.00
Autonomy	4.89	1.11	4.70	1.37	4.74	1.35	4.89	1.42	4.69	1.45	4.77	1.28	4.92	1.40	4.97	1.47	5.49	1.23	6.7	.00
Feedback from Job	4.63	1.18	4.79	1.35	4.78	1.33	4.93	1.34	4.79	1.40	4.83	1.26	4.90	1.30	4.87	1.34	4.97	1.40	1.9	.06
Feedback from Agents	4.22	1.20	4.17	1.54	4.10	1.59	4.11	1.61	3.92	1.61	4.05	1.64	4.21	1.53	4.25	1.39	4.38	1.41	3.3	.00
Dealing with Others	5.21	1.35	5.18	1.34	5.36	1.32	5.48	1.29	5.51	1.30	5.37	1.28	5.83	1.18	5.92	1.17	6.09	1.08	19.1	.00
MPS	111.53	48.11	115.30	62.65	117.73	68.00	131.12	72.03	120.63	70.24	124.45	64.83	130.18	72.47	137.48	80.99	153.64	76.34	9.5	.00
Experienced Meaningfulness	5.16	0.87	5.29	1.06	5.15	1.08	5.19	1.09	4.96	1.18	5.00	1.26	4.94	1.29	4.90	1.42	5.27	1.02	8.7	.00
Experienced Responsibility	5.58	0.84	5.44	0.96	5.38	0.97	5.42	0.92	5.40	0.91	5.45	1.05	5.44	0.95	5.42	1.03	5.75	0.82	2.6	.01
Knowledge of Results	5.03	1.15	5.08	1.14	5.12	1.11	5.09	1.14	4.98	1.16	5.02	1.16	4.94	1.19	4.86	1.16	4.90	1.12	3.7	.00
General Satisfaction	5.33	0.91	4.95	1.19	4.71	1.23	4.70	1.26	4.51	1.26	4.50	1.32	4.44	1.35	4.40	1.48	4.75	1.22	12.3	.00
Internal Motivation	5.15	0.97	5.60	0.82	5.49	0.88	5.53	0.86	5.46	0.94	5.54	0.88	5.54	0.87	5.51	0.91	5.74	0.84	3.5	.00
Pay Satisfaction	4.61	1.44	4.46	1.62	4.22	1.60	4.17	1.70	3.93	1.75	4.14	1.64	4.24	1.61	3.90	1.71	4.51	1.60	7.4	.00
Security Satisfaction	5.18	1.50	4.87	1.54	4.80	1.42	4.72	1.54	4.61	1.52	4.67	1.52	4.92	1.38	4.79	1.52	5.04	1.31	4.3	.00
Social Satisfaction	5.47	0.86	5.37	1.01	5.35	0.98	5.39	0.95	5.16	1.11	5.39	1.02	5.29	1.07	5.29	1.04	5.21	0.92	5.4	.00
Super. Satisfaction	5.42	1.35	4.99	1.54	4.81	1.55	4.86	1.57	4.58	1.66	4.83	1.62	4.92	1.42	4.76	1.50	5.06	1.55	5.8	.00
Growth Satisfaction	5.25	0.91	4.96	1.27	4.80	1.25	4.81	1.28	4.54	1.42	4.76	1.44	4.64	1.44	4.52	1.59	4.99	1.27	8.9	.00
Would like GNS	4.92	1.26	5.17	1.32	5.43	1.24	5.68	1.16	5.90	1.13	5.90	1.02	6.13	0.99	6.20	0.99	6.12	1.02	54.7	.00
Job Choice GNS	3.76	0.74	3.82	0.72	4.02	0.73	4.24	0.78	4.39	0.78	4.35	0.73	4.72	0.79	4.89	0.76	5.03	0.84	123.5	.00
Total GNS	4.34	0.86	4.50	0.82	4.72	0.83	4.96	0.81	5.15	0.81	5.12	0.72	5.42	0.76	5.55	0.70	5.58	0.82	110.5	.00
N (approx.)	51		553		2,415		1,052		1,187		283		595		231		111			

df = 8,469.

APPENDIX 4

O J P

JOB DIAGNOSTIC SURVEY

This questionnaire was developed as part of a Yale University study of jobs and how people react to them. The questionnaire helps to determine how jobs can be better designed, by obtaining information about how people react to different kinds of jobs.

On the following pages you will find several different kinds of questions about your job. Specific instructions are given at the start of each section. Please read them carefully. It should take no more than 25 minutes to complete the entire questionnaire. Please move through it quickly.

The questions are designed to obtain your perceptions of your job and your reactions to it.

There are no "trick" questions. Your individual answers will be kept completely confidential. Please answer each item as honestly and frankly as possible.

Thank you for your cooperation.

1.

SECTION ONE

This part of the questionnaire asks you to describe your job, as objectively as you can.

Please do not use this part of the questionnaire to show how much you like or dislike your job. Questions about that will come later. Instead, try to make your descriptions as accurate and as objective as you possibly can.

A **SAMPLE** question is given below.

A. To what extent does your job require you to work with mechanical equipment?

1----------2----------3----------4----------5----------(6)----------7

Very little; the job requires almost no contact with mechanical equipment of any kind.

Moderately

Very much, the job requires almost constand work with mechanical equipment.

You are to circle the number which is the most accurate description of your job.

If, for example, your job requires you to work with mechanical equipment a good deal of the time -- but also requires some paperwork -- you might circle the number six, as was done in the example above.

If you do not understand these instructions, please ask for assistance. If you do understand them, turn the page and begin.

2.

1. To what extent does your job require you to work closely with other people (either "clients", or people in related jobs in your own organization)?

1----------2----------3----------4----------5----------6----------7

Very little; dealing with other people is not at all necessary in doing the job.	Moderately; some dealing with others is necessary.	Very much; dealing with other people is an absolutely essential and crucial part of doing the job.

2. How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

1----------2----------3----------4----------5----------6----------7

Very little; the job gives me almost no personal "say" about how and when the work is done.	Moderate autonomy; many things are standardized and not under my control, but I can make some decisions about the work.	Very much; the job gives me almost complete responsibility for deciding how and when the work is done.

3. To what extent does your job involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?

1----------2----------3----------4----------5----------6----------7

My job is only a tiny part of the overall piece of work; the results of my activities cannot be seen in the final product or service.	My job is a moderate-sized "chunk" of the overall piece of work; my own contribution can be seen in the final outcome.	My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product or service.

4. How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?

1----------2----------3----------4----------5----------6----------7

Very little; the job requires me to do the same routine things over and over again.	Moderate variety	Very much; the job requires me to do many different things, using a number of different skills and talents.

3.

5. In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

1----------2----------3----------4----------5----------6----------7

Not very significant; the outcomes of my work are not likely to have important effects on other people.	Moderately significant.	Highly significant; the outcomes of my work can affect other people in very important ways.

6. To what extent do managers or co-workers let you know how well you are doing on your job?

1----------2----------3----------4----------5----------6----------7

Very little; people almost never let me know how well I am doing.	Moderately; sometimes people may give me "feedback;" other times they may not.	Very much; managers or co-workers provide me with almost constant "feedback" about how well I am doing.

7. To what extent does doing the job itself provide you with information about your work performance? That is, does the actual work itself provide clues about how well you are doing - aside from any "feedback" co-workers or supervisors may provide?

1----------2----------3----------4----------5----------6----------7

Very little; the job itself is set up so I could work forever without finding out how well I am doing.	Moderately; sometimes doing the job provides "feedback" to me; sometimes it does not.	Very much; the job is set up so that I get almost constant "feedback" as I work about how well I am doing.

4.

SECTION TWO

Listed below are a number of statements which could be used to describe a job.

You are to indicate whether each statement is an accurate or an inaccurate description of your job.

Once again please try to be as objective as you can in deciding how accurately each statement describes your job - regardless of whether you like or dislike your job.

Write a number in the blank beside each statement, based on the following scale:

How accurate is the statement in describing your job?

1	2	3	4	5	6	7
Very Inaccurate	Mostly Inaccurate	Slightly Inaccurate	Uncertain	Slightly Accurate	Mostly Accurate	Very Accurate

_____ 1. The job requires me to use a number of complex or high-level skills.

_____ 2. The job requires a lot of cooperative work with other people.

_____ 3. The job is arranged so that I do not have the chance to do an entire piece of work from beginning to end.

_____ 4. Just doing the work required by the job gives me many chances to figure out how well I am doing.

_____ 5. The job is quite simple and repetitive.

_____ 6. The job can be done adequately by a person working alone - without talking or checking with other people.

_____ 7. The supervisors and co-workers on this job almost never give me any "feedback" about how well I am doing in my work.

_____ 8. This job is one where a lot of other people can be affected by how well the work gets done.

_____ 9. The job denies me any chance to use my personal initiative or judgement in carrying out the work.

_____10. Supervisors often let me know how well they think I am performing the job.

_____11. The job provides me the chance to completely finish the pieces of work I begin.

_____12. The job itself provides very few clues about whether or not I am performing well.

_____13. The job gives me considerable opportunity for independence and freedom in how I do the work.

_____14. The job itself is not very significant or important in the broader scheme of things.

5.

SECTION THREE

Now please indicate how you personally feel about your job.

Each of the statements below is something that a person might say about his or her job. You are to indicate your own, personal feelings about your job by marking how much you agree with each of the statements.

Write a number in the blank for each statement, based on this scale:

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

_____ 1. It's hard, on this job, for me to care very much about whether or not the work gets done right.

_____ 2. My opinion of myself goes up when I do this job well.

_____ 3. Generally speaking, I am very satisfied with this job.

_____ 4. Most of the things I have to do on this job seem useless or trivial.

_____ 5. I usually know whether or not my work is satisfactory on this job.

_____ 6. I feel a great sense of personal satisfaction when I do this job well.

_____ 7. The work I do on this job is very meaningful to me.

_____ 8. I feel a very high degree of personal responsibility for the work I do on this job.

_____ 9. I frequently think of quitting this job.

_____10. I feel bad and unhappy when I discover that I have performed poorly on this job.

_____11. I often have trouble figuring out whether I'm doing well or poorly on this job.

_____12. I feel I should personally take the credit or blame for the results of my work on this job.

_____13. I am generally satisfied with the kind of work I do in this job.

_____14. My own feelings generally are not affected much one way or the other by how well I do on this job.

_____15. Whether or not this job gets done right is clearly my responsibility.

6.

SECTION FOUR

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

How satisfied are you with this aspect of your job?

1	2	3	4	5	6	7
Extremely Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Satisfied	Extremely Satisfied

_____ 1. The amount of job security I have.

_____ 2. The amount of pay and fringe benefits I receive.

_____ 3. The amount of personal growth and development I get in doing my job.

_____ 4. The people I talk to and work with on my job.

_____ 5. The degree of respect and fair treatment I receive from my boss.

_____ 6. The feeling of worthwhile accomplishment I get from doing my job.

_____ 7. The chance to get to know other people while on the job.

_____ 8. The amount of support and guidance I receive from my supervisor.

_____ 9. The degree to which I am fairly paid for what I contribute to this organization.

_____10. The amount of independent thought and action I can exercise in my job.

_____11. How secure things look for me in the future in this organization.

_____12. The chance to help other people while at work.

_____13. The amount of challenge in my job.

_____14. The overall quality of the supervision I receive in my work.

7.

SECTION FIVE

Now please think of the other people in your organization who hold the same job you do. If no one has exactly the same job as you, think of the job which is most similar to yours.

Please think about how accurately each of the statements describes the feelings of those people about the job.

It is quite all right if your answers here are different from when you described your own reactions to the job. Often different people feel quite differently about the same job.

Once again, write a number in the blank for each statement, based on this scale.

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

_____ 1. Most people on this job feel a great sense of personal satisfaction when they do the job well.

_____ 2. Most people on this job are very satisfied with the job.

_____ 3. Most people on this job feel that the work is useless or trivial.

_____ 4. Most people on this job feel a great deal of personal responsibility for the work they do.

_____ 5. Most people on this job have a pretty good idea of how well they are performing their work.

_____ 6. Most people on this job find the work very meaningful.

_____ 7. Most people on this job feel that whether or not the job gets done right is clearly their own responsibility.

_____ 8. People on this job often think of quitting.

_____ 9. Most people on this job feel bad or unhappy when they find that they have performed the work poorly.

_____10. Most people on this job have trouble figuring out whether they are doing a good or a bad job.

8.

SECTION SIX

Listed below are a number of characteristics which could be present on any job. People differ about how much they would like to have each one present in their own jobs. We are interested in learning how much you personally would like to have each one present in your job.

Using the scale below, please indicate the degree to which you would like to have each characteristic present in your job.

NOTE: The numbers on this scale are different from those used in previous scales.

4	5	6	7	8	9	10
Would like having this only a moderate amount (or less)			Would like having this very much			Would like having this extremely much

_____ 1. High respect and fair treatment from my supervisor.

_____ 2. Stimulating and challenging work.

_____ 3. Chances to exercise independent thought and action in my job.

_____ 4. Great job security.

_____ 5. Very friendly co-workers.

_____ 6. Opportunities to learn new things from my work.

_____ 7. High salary and good fringe benefits.

_____ 8. Opportunities to be creative and imaginative in my work.

_____ 9. Quick promotions.

_____10. Opportunities for personal growth and development in my job.

_____11. A sense of worthwhile accomplishment in my work.

9.

SECTION SEVEN

People differ in the kinds of jobs they would most like to hold. The questions in this section give you a chance to say just what it is about a job that is most important to you.

For each question, two different kinds of jobs are briefly described. You are to indicate which of the jobs you personally would prefer - if you had to make a choice between them.

In answering each question, assume that everything else about the jobs is the same. Pay attention only to the characteristics actually listed.

TWO EXAMPLES are given below

JOB A				JOB B
A job requiring work with mechanical equipment most of the day				A job requiring work with other people most of the day
1	2	(3)	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

If you like working with people and working with equipment equally well, you would circle the number 3, as has been done in the example.

* * * *

Here is another example. This one asks for a harder choice - between two jobs which both have some undesirable features.

JOB A				JOB B
A job requiring you to expose yourself to considerable physical danger.				A job located 200 miles from your home and family.
1	(2)	3	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

If you would slightly prefer risking physical danger to working far from your home, you would circle number 2, as has been done in the example.

Please ask for assistance if you do not understand exactly how to do these questions.

10.

	JOB A			JOB B
1.	A job where the pay is very good.			A job where there is considerable opportunity to be creative and innovative.

1	2	3	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

2.	A job where you are often required to make important decisions.			A job with many pleasant people to work with.

1	2	3	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

3.	A job in which greater responsibility is given to those who do the best work.			A job in which greater responsibility is given to loyal employees who have the most seniority.

1	2	3	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

4.	A job in an organization which is in financial trouble - and might have to close down within the year.			A job in which you are not allowed to have any say whatever in how your work is scheduled, or in the procedures to be used in carrying it out.

1	2	3	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

5.	A very routine job.			A job where your co-workers are not very friendly.

1	2	3	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

6.	A job with a supervisor who is often very critical of you and your work in front of other people.			A job which prevents you from using a number of skills that you worked hard to develop.

1	2	3	4	5
Strongly Prefer A	Slightly Prefer A	Neutral	Slightly Prefer B	Strongly Prefer B

11.

	JOB A			JOB B
7.	A job with a supervisor who respects you and treats you fairly.			A job which provides constant opportunities for you to learn new and interesting things.
	1 Strongly Prefer A	2 Slightly Prefer A	3 Neutral	4 Slightly Prefer B	5 Strongly Prefer B
8.	A job where there is a real chance you could be laid off.			A job with very little chance to do challenging work.
	1 Strongly Prefer A	2 Slightly Prefer A	3 Neutral	4 Slightly Prefer B	5 Strongly Prefer B
9.	A job in which there is a real chance for you to develop new skills and advance in the organization.			A job which provides lots of vacation time and excellent fringe benefits.
	1 Strongly Prefer A	2 Slightly Prefer A	3 Neutral	4 Slightly Prefer B	5 Strongly Prefer B
10.	A job with little freedom and independence to do your work in the way you think best.			A job where the working conditions are poor.
	1 Strongly Prefer A	2 Slightly Prefer A	3 Neutral	4 Slightly Prefer B	5 Strongly Prefer B
11.	A job with very satisfying team-work.			A job which allows you to use your skills and abilities to the fullest extent.
	1 Strongly Prefer A	2 Slightly Prefer A	3 Neutral	4 Slightly Prefer B	5 Strongly Prefer B
12.	A job which offers little or no challenge.			A job which requires you to be completely isolated from co-workers.
	1 Strongly Prefer A	2 Slightly Prefer A	3 Neutral	4 Slightly Prefer B	5 Strongly Prefer B